THE BRITISH JOURNAL

OF

OPHTHALMOLOGY

FEBRUARY, 1945

COMMUNICATIONS

PENICILLIN AND THE CONTROL OF DEEP INTRA-OCULAR INFECTION*

BY

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DEEP infections of the eye due to penetrating wounds present to military ophthalmologists a major problem, the solution of which would go far in limiting the total blindness which so often results.

For many months this problem has engaged the attention of all ophthalmologists in the British North African and Central Mediterranean Forces; the results of their efforts to date (September, 1944) are contained in this account.

Types of ocular wounds

Wounds of the eyes tell the story of a battle and whether an army is advancing, entrenched, or in retreat. When an army advances mines are the greatest menace, but when it is stationary, machine-gun bullets, mortars and grenades account for many wounds: in retreat, wounds by shellfire are prominent.

Mine wounds have been a marked feature of the recent warfare in Italy. The nature of the country and the Winter of 1943-4 enabled the Germans to graft a strong defensive system along a line of natural barriers, and no mean part of this system was the

* Received for publication, December 6, 1944.

DIAGRAM 1.

CASE 2C.—The result of injuries from a Schu mine. There is extensive peppering of the skin of the face and neck by minute grit particles which give a typical bluish discolouration. The lids of the right eye are extensively lacerated and the globe was disintegrated.
The blast oedema of the left lids is well seen: this persisted for three weeks after the wound was received.
Foreign bodies were found at all depths in the left cornea; at least twenty stone particles were removed, but many remained. There was penetration of the cornea, iris and lens, with purulent keratitis, hypopyon, iritis, traumatic cataract, and secondary glaucoma. Vision on discharge to United Kingdom was "hand movements (gross)."
Other injuries were trivial.
This N.C.O. went to the rescue of an officer in an uncleared minefield.
The illustration was made a fortnight after being wounded.

development of elaborate mine warfare. These wounds are characterised by multiple small foreign bodies of the face, hands, and chest wall, together with gross infection by mud, gravel, and clothing: one or both feet are also frequently blown away.

In the eyes, the significance of these wounds is that they are caused by tiny stone foreign bodies which penetrate the cornea to all depths, traverse the anterior chamber, and by penetrating the iris and lens reach the anterior vitreous; they result in purulent keratitis, hypopyon, iritis, cataract, and endophthalmitis, with infection all the way.

These foreign bodies vary according to the nature of the mine which produces them. From Teller and "S" mines they are generally of steel, but the igniters of any mine may be composed of aluminium (DZ 35A) or brass (DZ 35B or ZZ 35); the containers may be of wood (Schu mine 42), concrete (Stock) or bakelite, relying for their devastating anti-personnel effect on blast. When blast is severe, the minute grit foreign bodies driven into the eye cause the utmost physiological damage, whereas elsewhere, as for example in the skin of the face, they are of little consequence.

The latest anti-personnel Schu mine contains practically no metal, and is consequently extremely difficult to detect in daylight and almost impossible at night.

From the ophthalmic standpoint, this mine is the greatest menace, relying as it does mainly on blast and producing a multitude of wounds with non-magnetisable foreign bodies, such as stone, and with almost inevitable infection.

When enemy resistance halts an army, there is more danger of wounds from trained machine-guns. Machine-gun bullet "spatter" generally results in a nickel or stone intra-ocular foreign body with problems of removal rather than of infection.

Shells, mortars and grenades give rise to a variety of lesions varying from the tiny chips of intra-ocular steel which are easily removed, to large pieces which disintegrate the globe, open the skull, and cause death by haemorrhage or meningitis.

It is generally agreed that in this campaign, mortar wounds have been the most serious of all.

Pathology

The problem under consideration is that of the deep infections of the eye which these varied missiles may cause. These may be classified as follows:—

Cornea. (*a*) Single ragged penetrating wound. (*b*) Retained multiple foreign bodies at all depths causing diffuse purulent infiltration.

Anterior Chamber. (*a*) Retained single or multiple foreign

bodies which may be infected or non-infected. (*b*) Hypopyon (anterior). (*c*) Hyphaema.

Iris. (*a*) Infected holes. (*b*) Retained foreign bodies causing iritis.

Lens. (*a*) Infection of lens matter under or outside the lens capsule. (*b*) Retained infected foreign bodies within the lens.

Vitreous. (*a*) Retained infected foreign bodies, usually within the anterior segment. (*b*) Posterior hypopyon (quiet endophthalmitis). (*c*) Panophthalmitis (abscess of the vitreous).

Wounds of the eye often suggest the type of missile which caused them. The ragged single dirty penetrating wound of the cornea with prolapse of iris or lens capsule, traumatic cataract and retention of a foreign body in the vitreous frequently characterises a small shell or mortar fragment, whilst the tiny almost invisible limbal wound, the small iris hole, the retention of vision and normal tension occurs from the "hammer and chisel" foreign body of a tank workshop.

Tiny circular deep and penetrating wounds of the cornea which extend across the interpalpebral portions with gross dirt contamination bespeak a mine. Foreign bodies lie at any depth up to the anterior vitreous and at all depths generally show infection with calamitous effects on vision.

In the anterior chamber, hypopyon is frequent and may be the result of any infected corneal wound, but when also associated with deep purulent infiltration of the cornea the risk of permanent blindness is great from subsequent organisation and fibrosis. Hypopyon in the anterior chamber should be designated "anterior hypopyon" to distinguish it from a similar sterile exudation behind the iris, which it is proposed should be named "posterior hypopyon."

Infection of the iris is brought about in a similar manner; holes are torn, vessels distend, the pattern dies away, the colour changes with blood or exudate and posterior synechiae soon form. Sometimes infection can be seen to spread from a tiny foreign body caught up in the stroma.

Lens infection has not been found to be common. Pouting lens flocculi in the anterior chamber change from grey to yellow and then absorb, but it has not been possible to say definitely whether true infection was present or not. On the other hand, tracks with or without foreign bodies are very common, passing in all directions through the cortex.

Vitreous infection presents an interesting picture which could only be painted in wartime. It is most frequently seen in the anterior segment from stone or grit: ferrous foreign bodies are not allowed these days to remain long enough to set up deep reactions, and non-ferrous metals are often free from reaction.

Infection of the vitreous is seen as two types:—

(*a*) In the eye which appears relatively quiet. There is little conjunctival oedema or loss of corneal lustre and the anterior chamber is clear. Behind the lens, however, is seen a yellow exudate spreading with finger-like processes across the vitreous chamber: it is seen to increase day by day. There is little pain, but a gradual diminution in the perception of light follows. Until the condition is well advanced tension remains normal, but in the later stages it falls commensurate with the degree of shrinkage of the globe.

The general appearance of such an eye does not suggest an acute inflammatory process within, but rather the gradual accumulation of exudation which indeed there is. The exudate appears to have all the characteristics of a hypopyon in that it is sterile, forms gradually and is not accompanied by severe local reaction.

(*b*) That which shows as an acute crisis of inflammation with severe pain, lid and conjunctival oedema, haziness of the cornea and media, and a dirty yellow reflex behind the lens. Tension is high, perception of light is soon lost, and the end is frequently perforation.

The latter type has been much less common than the former in this Force since extensive mine warfare began.

The bacteriology of these lesions will be noted when individual cases are described.

The prevention of deep intra-ocular infections in war

Since the causes of deep intra-ocular infection are known, namely the production of penetrating wounds by foreign bodies and contamination by organisms, some thought must be given to attempts at prevention.

War cannot be waged without casualties, but a small proportion of eye wounds would appear to be preventable.

(*a*) Time and again men have been blinded by mines which were known to be about and when obvious risks had to be taken. Such circumstances arise when an area has to be cleared or a comrade rescued from a minefield. The preventable portion is about 40 per cent. of all mine casualties.

For these occasions a Perspex anti-mine vizor has been devised in this theatre. This vizor is made of $\frac{1}{8}$ in. Perspex and weighs two and a quarter ounces: it is fixed to the head with tapes and allows a full field of vision thereby differing from former types which tended to be blown off by blast or restricted peripheral vision. The vizor is primarily intended to be a protection for sappers and assault pioneers when clearing an area of Schu mines, these being notoriously difficult to detect. It will not stop bullets or large grenade fragments.

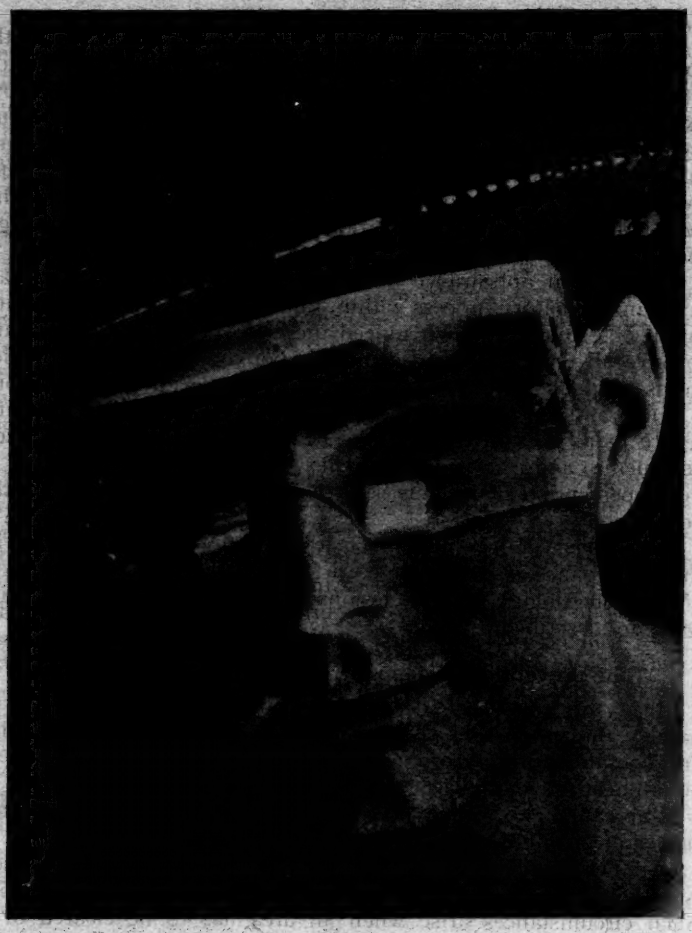


DIAGRAM 2.

Perspex Anti-Mine Vizor.—This vizor is constructed from ⅛ in. Perspex as used in aircraft turrets. It is padded by strips of standard orthopaedic felt and secured to the head by tapes or elastic. Air holes are drilled at all borders and in the temporal areas.

It weighs about 2¼ ozs. and will stop small fragments at close range, especially stone particles. The vizor is primarily designed to protect the eyes of those dealing with known and unknown Schu mines; for example, it would have saved Case 2.c.

On trial, personnel of the Eighth Army report the advantages that the morale is increased, and there is a definite place for such protection in modern warfare.

Disadvantages noted are that occasionally there are optical defects due to unequal contraction of the material on cooling; that the material scratches and that glint may give away positions to the enemy. These difficulties are being overcome by improved methods of manufacture and a new type which eliminates distortion and directs reflected rays downwards.

Up to the present the vizor has been tried with the Eighth Army and issues are to be made. It remains to be seen how effective it will prove to be, but at any rate those concerned in actual field trials have approved it and requested issues as a rational attempt at prevention of blindness.

(*b*) Casualties of all types nowadays come under early skilled examination at Advance Dressing Stations (A.D.S.). Thanks to the co-operation of Brigadier Stammers, Consulting Surgeon, Eighth Army, it has been possible to direct the attention of general surgeons to the care of eye wounds at a very early stage and so to institute simple measures calculated to reduce infection.

Forward surgeons have all been asked to carry out the following recommendations and already the results show considerable promise.

Suggestions to surgeons in the forward areas in the early care of ophthalmic cases

(1) The skin of the lids should be carefully cleaned and gross debris removed.

(2) Loose foreign bodies should be removed from the conjunctival sacs.

Irrigation of the eye is contra-indicated except under anaesthesia as it may cause squeezing and further extrusion of ocular contents after a penetrating wound.

(3) Cut the lashes with vaselined scissors in every case of lid or eye injury and burns.

(4) Atropine is used in every wounded eye.

(5) Tie up the eye with a pad and bandage if there is a penetrating wound.

(6) If the cornea looks like being exposed, stitch the lid to the cheek with a simple temporary anchor stitch: if there is no lid, cover with vaseline gauze.

(7) Only complete disorganisation of the eye is an indication for removal in forward areas.

(8) Every corps has a mobile ophthalmic unit attached to a Forward C.C.S., a skilled ophthalmic surgeon is available there and the repair and renewal of spectacles can also be undertaken on the spot.

(*c*) Mobile ophthalmic units are the next link in this prophylactic chain. These units are staffed by skilled surgeons of experience who command full equipment; they function within a few miles of the line and are attached to a "bottle neck" C.C.S. Ophthalmic cases reach them within an hour or two of injury so that one potent factor in the cause of infection, namely, time lag after wounding, is much reduced.

The duty of these forward ophthalmologists is to clean up the eye, to attempt the removal of the intra-ocular foreign body through the wound of entry, to excise prolapses, apply penicillin, and seal the wounds securely by conjunctival flaps. In other words eyes are made " travel safe " and early ingress of infection prevented. Sixty per cent. of intra-ocular foreign bodies are removed at the mobile units.

Should the foreign body not yield to hand or giant magnet attraction, the toilet of the wound proceeds in a similar manner and the case is then evacuated by air to a Base ophthalmic wing.

The value of these mobile units cannot be too strongly stressed not only because of the expert surgery which they offer at such an early stage, but because of the facilities for the immediate supply and repair of spectacles with the consequent saving of manpower in forward areas or isolated landings.

To summarise, as a result of experience of three campaigns the measures to be recommended for the prevention of ocular infection are as follows :—

(1) The provision of anti-mine vizors for selected troops.

(2) Early attention to ophthalmic cases by forward general surgeons.

(3) Early magnet applications and removal of intra-ocular foreign bodies from entry wounds, excision of prolapses and closure of wounds by skilled ophthalmic surgeons.

(4) Insufflation of pulv. Ca. Penicillin into every case of penetrating wound of the eye.

(5) Air evacuation to a Base ophthalmic wing. When cases reach this stage the chances of preventing the infection have diminished : treatment of the established condition supervenes.

The treatment of deep intra-ocular infections

On arrival at a Base ophthalmic wing, the following special measures are taken in addition to the ordinary routine of treatment, namely :—

(1) Complete radiographic investigation and localisation by equatorial or limbal rings followed by the removal of intra-ocular foreign bodies by formal surgery.

(2) Sulphonamide therapy.

(3) Non-specific protein therapy.

(4) Penicillin therapy.

(5) Surgical treatment.

(1) *Intra-ocular foreign bodies.*—It is difficult to say how often a ferrous intra-ocular body is associated, or would be associated, with deep infection since so many are removed in the early stages and repeated cultures of such foreign bodies after removal are

sterile. Certainly the combination of retained ferrous intra-ocular foreign body and acute sepsis is not particularly frequent in this campaign.

More so is the case with aluminium and alloys which are so frequently clearly seen in the vitreous chamber free of irritation and infection. But with stone the story is different and infection of the eye is the rule.

The working principle for removal of metal intra-ocular foreign bodies is that at a Base ophthalmic wing a surgical attempt after localisation is always undertaken and direct magnet approach carried out. The negative subjective response to a "magnet test" is of no value since time and again ferrous foreign bodies have been seen in the vitreous to leap to the magnet and yet the patient complained of no discomfort. The details of these operations have been so well described by Stallard and Skeoch that there is little more to add.

In the case of superficial stone foreign bodies the rule is to remove those from the cornea which it is possible to dislodge readily and afterwards to carbolise the wounds: this procedure has to be frequently repeated as the case progresses.

(2) *Sulphonamide therapy.*—All cases with intra-ocular foreign bodies are given a course of sulphonamide therapy as a routine. There is not the least doubt that this is of benefit for the ocular infection as well as for infection of other coincident wounds, which are generally present. The usual course commences with an initial dose of 3 grms. (6 tablets) followed by 2 grms. (4 tablets) four hourly day and night for three days making a total course of 37 grms. Sulphathiazole is the drug of choice except where there is reason to believe the skull has been opened in which case sulphadiazine, on account of excretion into the cerebro-spinal fluid, is preferred. The usual precautions as to alkaline fluid intake, urine control, white cell blood counts are observed.

Infective lesions which respond quickly are those of vascular areas such as the uveal tract, whereas in corneal wounds the effect is not so marked. Nor has any marked benefit been seen from it in closed endophthalmitis.

In mine wounds with gross sepsis of the face and lids it is of particular value.

(3) *Non-specific protein therapy.*—Many substances have been recommended to produce artificial pyrexia in the treatment of ocular infection, but for ease of technique, availability, and certainty of result there is little to beat the intravenous injection of T.A.B. vaccine. The relationship of the pyrexia produced to the dose employed is reasonably constant and an initial dose of 50-75 millions may be expected to produce a fever of 101-102 deg. F.

After three days, a second dose of 75-100 millions may be employed and more than two doses are rarely required. Heavier doses will produce higher temperatures, but they have the disadvantage of also producing herpetic lesions which are non-specific and may occur in any high pyrexia. Herpes labialis is of little consequence; herpes of the cornea, as noted in one Italian P.O.W., after a high dose is the only serious complication which has been seen.

It may be categorically stated that as a result of the general reaction from T.A.B. protein shock, almost any hypopyon will disappear, and it is for this condition and sub-acute iritis that the method is of such value in military practice. In corneal infections alone the results, though definitely beneficial, are not so startling: in closed endophthalmitis they are encouraging, but of transient benefit only.

Protein shock is never given coincidentally with a course of sulphonamides, as the sweating which results from the former may cause dangerous concentrations of the latter in the urine, especially in hot climates. The method of choice is first to assess the value of a sulphonamide course and then to boost the treatment by intravenous T.A.B. injections if necessary.

(4) *Penicillin therapy.*—Great interest has centred round the value of this drug in ocular conditions; it has been used by most ophthalmologists in this Theatre on hundreds of cases for over seven months. Reports from them have been forwarded to Headquarters, and their conclusions are briefly as follows:—

(i) That penicillin is of great value for superficial infections of the conjunctiva and sockets (Majors C. Cockburn, W. D. Hamilton, and Captain C. Brown).

(ii) That the drug effectively prevents infection of the conjunctiva when used early after operation, such as was commonly seen around stitches in conjunctival flaps, etc. The "fourth day" bead of pus at the base of conjunctival sutures has now practically vanished (Majors B. Gluck and E. C. Zorab).

(iii) That routine application by forward ophthalmologists results in the arrival of cleaner eyes at the base; this feature is particularly noticeable when Sicilian and Tunisian battle casualties are compared with those of the C.M.F. (Majors H. H. Skeoch, R. McIvor Paton, and Lindsay Burns).

(iv) That penicillin has no great value in the treatment of corneal ulceration, unless secondary to conjunctivitis (Captain C. Brown).

Other investigators, namely, Cashell, Crawford and King, and Milner, obtained similar results. Therefore, for superficial infections of the eye, the value of penicillin must now be considered

well proven: but for deep infections the remedy had yet to be tried.

The rapid advance of the Allied Armies to Naples did not involve them to any great extent in mine warfare, and a high degree of eye infection from this cause did not therefore occur, but at Cassino the terrain and the tactics of the enemy defence abruptly changed.

"All roads lead to Rome, but unfortunately all the roads are mined" said General Alexander—they certainly were, and the hills too! The month of May, 1944, brought the attack on Cassino, and as the mine warfare intensified, so did the frequency of the deep ocular sepsis. It seemed profitable to investigate the value of penicillin in the treatment of this deep sepsis in view of what might be expected in other theatres of war.

Military ophthalmologists were asking for answers to these queries:—

(1) What is the most effective form in which to use penicillin?
(2) What are ophthalmic incompatibilities?
(3) What effect has the drug on established intra-ocular sepsis?

These queries required speedy answers.

Methods of application

1. *Drops.*—Sodium Penicillin (1,000 units to 1 c.c. distilled water) is useful for conjunctival lesions when frequently used. The disadvantages are the need of frequent preparation and careful cold storage.

2. *Ointment.*—The most suitable base which retains penicillin is lanette wax as the following simple experiments show. The table shows the potency of penicillin in vaseline, lanoline, and lanette wax kept in room temperature over a period of several days.

Clinical trials already suggest a profitable field in the treatment of sebaceous chronic blepharitis, bugbear of all military outpatient departments.

3. *Powder.*—The value of this form of application lies in the persistence of the drug action, a point of moment when wounded men are to be evacuated and continuity of treatment interrupted. Mixed with sulphathiazole or sulfanilamide (2,000 units per gramme of powder), it is the method of choice for military ophthalmologists in forward areas since it keeps well, is portable and is easily applied.

Here it is insufflated as a routine in all cases of penetrating wounds of the eye. Occasionally the powder is irritable and appears to aggravate an infection. This is due more to the sulpha vehicle rather than to the penicillin, and a change should accordingly be made to drops.

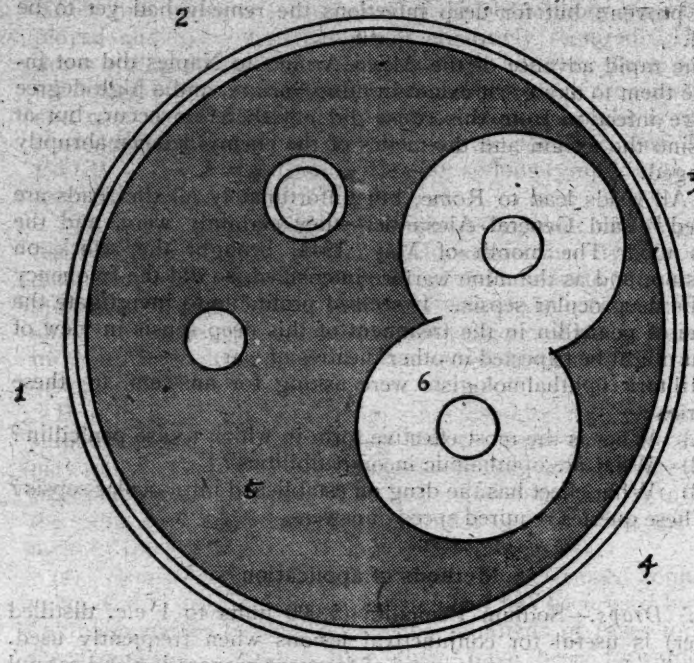


DIAGRAM 3.

1. Vaseline with penicillin. 2. Adipis lanae with penicillin. 3. Lanette wax with penicillin. 4. Penicillin 10 units per c.c. (control). 5. Shading = S. aureus haem. 6. Area of bacterial inhibition.

This diagram shows the bacterial inhibition which remained at the end of 12 days during which the plate was kept at room temperature. The test is crude and qualitative, and it is not possible to ensure that the vehicle is equally distributed in each hole, but it does show that lanette wax retains the penicillin longer than the other vehicles.

Hole No. 1.—500 units penicillin per gramme vaseline. Hole No. 2.—500 units penicillin per gramme lanoline. Hole No. 3.—500 units penicillin per gramme lanette wax. Hole No. 4.—10 units penicillin as control in water.

	June 29	June 30	July 3	July 11
Base		After 1 day	After 4 days	After 12 days
10 units penicillin in distilled water		14 mm.	12 mm.	12 mm.
Lanoline and 500 units penicillin per gramme		5 mm.	Nil-1 mm.	Nil-1 mm.
Vaseline and 500 units penicillin per gramme		9 mm.	1 mm.	Nil.
Lanete wax and 500 units penicillin per gramme		13 mm.	12 mm.	12 mm.

1. The numbers refer to the increase in diameter in millimetres of the circles of bacterial inhibition.

2. It will be noted that after 12 days the activity of penicillin in lanette wax was still present, whereas in lanoline and vaseline it had almost died away.

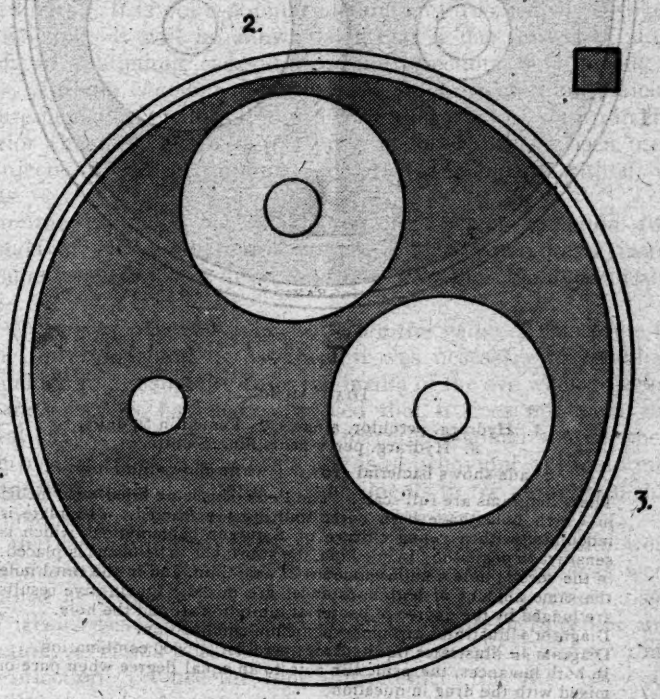
Incompatibilities

The local ocular incompatibilities were checked by using a Petri dish preparation as described later.

Fifty units of penicillin in distilled water were placed in one hole : this gave a uniform inhibition of growth of 36 mm. diameter.

In the second hole only the substance to be tested was placed : *e.g.*, proflavine 1/4,000 produced a circle of 3 mm. increase inhibition, liq. hydrarg perchlor. 1/5,000 produced a 4 mm. increase circle, whilst pure carbolic acid extended to 10 mm. increase.

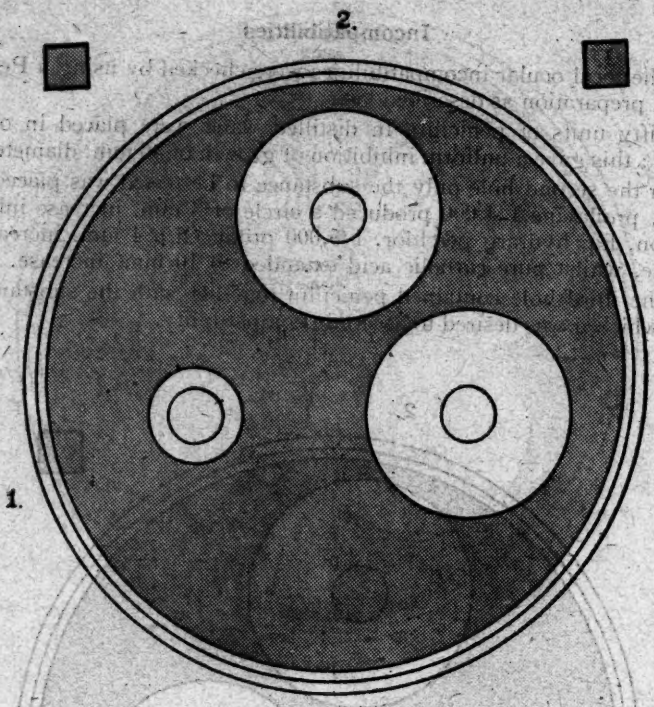
The third hole contained penicillin together with the substance for which it was desired to ascertain compatibility.



B.

DIAGRAM 4.

1. Atropine alone. 2. Penicillin 50 units. Atropine+penicillin, 50 units.



I.

DIAGRAM 4*a*.

1. Hydrarg. perchlor. alone. 2. Penicillin 50 units.
3. Hydrarg. per. + penicillin, 50 units.

Shade shows bacterial growth; white shows inhibition.

These diagrams are full scale. The Petri dishes are filled with media in which holes have been bored and discs extracted. The plate is inoculated with a young culture of S.aureus haemolyticus which is sensitive to penicillin. In one hole, the substance to be tested is placed, in the second hole a known amount of penicillin, and in the third hole the same amount of both substances are mixed. Qualitative results are judged by the degree of bacterial inhibition around the hole.
Diagram 4 illustrates atropine—penicillin combination.
Diagram 4*a* illustrates liq. hydrarg. perchlor. 1 5000 combination.
In both instances, the penicillin acts to an equal degree when pure or mixed with the drug in question.

The following table briefly summarises the results and shows that by these qualitative crude tests, penicillin is not inhibited by any of the ocular remedies mentioned in common use.

The figures refer to the size of the circle of bacterial inhibition.

Substance	Bacterial inhibition of substance alone	Bacterial inhibition of substance with 50 units penicillin
Gtt. adrenalin hydrochlor. 1/1000	Nil	36 mm. diameter
Gtt. atropine sulph. 1 per cent.	Nil	36 mm. diameter
Gtt. cocaine hydr. 4 per cent. ...	Nil	36 mm. diameter
Gtt. Novutox 2 per cent. ...	Nil	36 mm. diameter
Gtt. albucid 30 per cent. ...	Nil	36 mm. diameter
Gtt. proflavine 1/4000	3 mm. diameter increase	36 mm. diameter
Gtt. pure acid carbolic	10 mm. diameter increase	36 mm. diameter
Gtt. argyrol 20 per cent. ...	Nil	36 mm. diameter
Liq. hydrarg. perchlor. 1/5000...	4 mm. diameter increase	36 mm. diameter
Penicillin 50 units	36 mm. diameter increase	—

4. INJECTIONS. (*a*) *Intramuscular.*—1,500 units of Sod. Penicillin are dissolved in 2 c.c. sterile water and administered every three hours. It is not a popular method and it is heartily disliked by patients. It will be shown later that it has proved of little benefit in ophthalmic cases, but orbital infections may benefit.

(*b*) *Anterior chamber.*—The extreme solubility and low toxicity of pure penicillin enables a high concentration to be set up in the anterior chamber. Here, 1,000 units per minim have been used for injections into the anterior and vitreous chambers without ill effects.

For the treatment of established intra-ocular infection two methods of choice therefore present, namely parenteral intramuscular injection and direct injection into the chambers of the eye.

1. *Intramuscular injections.*—Before the value of this route to ocular infection could be assessed, it was necessary to establish that penicillin did actually enter the media of the eye when injected into muscles. It has been observed that it does not enter the pleural cavity, the synovial cavity or cerebro-spinal spaces when given by this route, but information as to behaviour to the normal or abnormal eye was lacking. Experiments to try and obtain this information were conducted in the following manner.

In the case of normal eyes, large injections of penicillin were given intramuscularly to moribund patients and their eyes were examined as speedily as possible post-mortem. For traumatised eyes, it was easier to shorten the time lag between injection and collection, as it was possible to examine the media at a given time after injection. Hence the time opportunity for the assay of normal eyes arrived less quickly than it did for abnormal eyes.

Two methods of penicillin assay were employed :—

(*a*) *Plate Test.*—A Petri dish containing blood agar had five circles of 8 mm. diameter removed by a cork borer, leaving shallow holes. Thereafter it was sterilised and inoculated with a young culture of penicillin-sensitive Oxford S. aureus.

Into one hole was placed 50 units of penicillin in distilled water which produced a circle of bacterial inhibition 12-14 mm. wide: one hole was left blank as a control. Into the others were placed the fluids in which it was desirable to defect the presence of penicillin: this was shown by inhibition of staphylococcal growth around the hole. Although this test is crude and not sensitive for small amounts it was a useful clinical and qualitative indication.

(*b*) *Dilution test.*—The material to be tested was put up in various dilutions with normal saline, for example, aqueous and vitreous fluids neat, and with $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, and 1/16 dilutions.

One-fifteenth c.c. of each was placed in a small test tube to which 1/50th c.c. glucose was added for bacterial growth.

Each tube was then subcultured to exclude contaminants. To each tube was then added 1/50th S. aureus haemolyticus suspension which had been previously proved to be penicillin sensitive. This amount was approximately equivalent to 5 millions staphylococci.

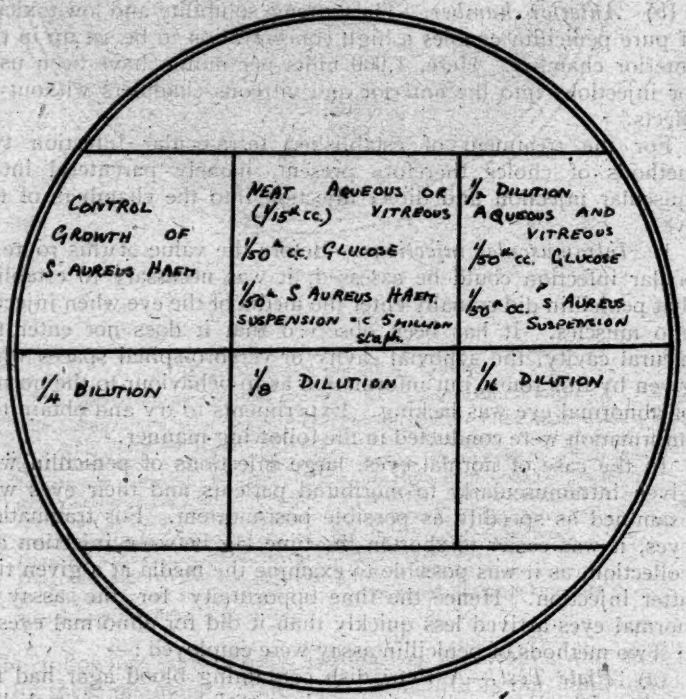


DIAGRAM 5.

Penicillin dilution test.

NORMAL EYES. *Media Collected Post-Mortem Dilution Test.*

No.	Name	Nat.	History	Penicillin	Collection	Assay Result	Remarks
1	Cpl. S. ...	P.	Wounded May 24. Large shell fragment passed through left orbit into the left temporo-sphenoidal lobe. Died May 28, 23.40 hours	I.M. course ½ million units May 25-27. 1500 units 22.00 hours, May 27	Right eye 09.00 hours, May 29 (*a*) 9½ hours after death (*b*) 35 hours after last dose	A. No inhibition V. No inhibition	This case is not satisfactory owing to lapse of time between the last dose and collection
2	Pte. D. ...	B.	Wounded May 23. Penetrating head wound through right temporal fossa. Penetrating wounds of chest and abdomen. Died 03.00 hours, May 24	Nil	Left eye 09.45 hours, May 24 (*a*) 6¾ hours after death (*b*) not applicable	A. No inhibition V. No inhibition	This was a control case to examine whether any natural inhibiting substances were present in the ocular media
3	Fus. Mc.G.	B.	Wounded May 16. Penetrating wound of head by shell fragment which lacerated left temporal lobe. Basal meningitis. Died 17.25 hrs., May 29	I.M. course terminating with last dose at 16.30 hours, May 29	Right eye 11.30 hours, May 30 (*a*) 18 hours after death (*b*) 19 hours after last dose	A. No inhibition V. No inhibition	Also rather a late case
4	Tpr. B. ...	B.	Wounded May 28. Mortar fragments caused penetrating wounds of left occiput, chest and buttock. Died 03.00 hours, May 29	I.M. course May 28-29. Last dose 02.00 hours, May 29	Right eye 09.00 hours, May 29 (*a*) 6 hours after death (*b*) 7 hours after last dose	A. No inhibition V. No inhibition	—
5	Gdsn. G.	B.	Wounded May 26. Penetrating shell wound of head and face with extensive laceration of the brain. Died 04.00 hours, May 28	Nil	Left eye 10.00 hours, May 28 (*a*) 6 hours after death (*b*) not applicable	A. No inhibition V. No inhibition	Control case

NORMAL EYES. *Media Collected Post-Mortem Dilution Test—continued.*

No.	Name	Nat.	History	Penicillin	Collection	Assay	Remarks
6	Spr. B. ...	B.	Extensive burns (primus) of face, trunk and arms, May 16. Died 19.00 hours, May 29	Two courses (I.M.) (*a*) May 18-21, 350,090 units (*b*) May 26-29, 390,000 units Last dose 18.00 hours, May 29	Right eye 22.00 hours, May 29 (*a*) 3 hours after death (*b*) 4 hours after last dose	A. No inhibition V. No inhibition	Short interval between dose, collection and assay
7	Spr. M. S.	Ind.	Wounded May 29. Penetrating wounds of head, chest and abdomen by mortar fragments. Died 22.00 hours, May 29	I.M. dose 30,000 units at 18.00 hours	Right eye 24.00 hours, May 29 (*a*) 2 hours after death (*b*) 6 hours after last dose	A. No inhibition V. No inhibition	—

ABNORMAL EYES. *(Traumatised).*

No.	Name	Nat.	History	Penicillin	Collection	Assay	Remarks
1a	Gnr. W.	B.	Wounded May 13. Mortar fragment entered left orbit and passed into the skull through the roof. It lacerated the left temporo-sphenoidal lobe, crossed the middle fossa and ended up in the right temporo-sphenoidal lobe. Died May 20, 22.00 hours	I.M. Penicillin May 15-20. Last dose 20.00 hours, May 20	Right eye: avulsion of the optic nerve with intra-ocular haemorrhage. 09·00 hours, May 21. (*a*) 11 hours after death (*b*) 13 hours after last dose	A. No bacteriostasis V. No inhibition	—

ABNORMAL EYES. *(Traumatised)—continued.*

No.	Name	Nat.	History	Penicillin	Collection	Assay	Remarks
2a	Pte. C. ...	B.	Wounded May 19. Shell fragment shattered the mandible and left maxilla. Died from gas gangrene, 20.00 hours, May 20	One dose 30,000 units 18.00 hours, May 20	Left eye contusion of globe. Vitreous haemorrhage 21.00 hours, May 20 (*a*) One hour after death (*b*) 3 hours aiter last dose	A. Slight bacteriostasis V. Slight bacteriostasis	This was an early case and the only one in the series which showed slight bacterial inhibition
3a	Pte. G. ...	B.	Wounded May 30. Mortar fragments spattered face and entered the left eye. The left eye had a penetrating wound with large prolapse of iris. On June 20 there was endophthalmitis and low tension with considerable irritation. Enucleation June 28: section showed almost total retinal detachment with extensive infiltration of the vitreous	June 28, I.M. (*a*) 15,000 units, 07.00 hours (*b*) 15,000, units, 09.00 hours (*c*) Enucleation 09.30 hours	(*a*) Not applicable (*b*) Half-hour after last dose	A. No inhibition V. No inhibition	—
4a	Spr. L. ...	B.	Wounded May 31. Extensive mine wounds of face, eyes and hands: penetrating wounds of the right eye with prolapse of iris; multiple intra-ocular foreign bodies. June 20, extensive infiltration of vitreous: endophthalmitis. No P.L. Enucleation June 28	June 28, I.M. (*a*) 15,000 units, 06.30 hours (*b*) 15,000 units, 07.30 hours (*c*) Fnucleation 09.30 hours	(*a*) Not applicable (*b*) 2 hours after last dose	A. No inhibition V. No inhibition	—

ABNORMAL EYES. *(Traumatised)—continued.*

No.	Name	Nat.	History	Penicillin	Collection	Assay	Remarks
5a	Spr. J. ...	P.	Wounded May 13. Multiple shell wounds of face and chest. Penetrating wound of left eye with retained intraocular foreign body. This was removed by magnet extraction but on June 16 the eye was shrinking, soft and irritable. Enucleation June 28	June 28, I.M. (*a*) 15,000 units, 08.00 hours (*b*) 15,000 units, 09.30 hours (*c*) Enucleation 10.00 hours	(*a*) Not applicable (*b*) Half-hour after last dose	A. No inhibition V. No inhibition	—
6a	Pte. P. ...	B.	Wounded May 30. Multiple shell wounds of face, chest, arms and legs. T and T penetrating wound of right eye. Enucleation June 7	June 7, I.M. (*a*) 15,000 units, 12.00 hours (*b*) 15,000 units, 14.00 hours (*c*) Enucleation 15.00 hours	(*a*) Not applicable (*b*) One hour after last dose	A. No inhibition V. No inhibition	—
7a	Pte. S. K.	I.	Wounded July 28. Multiple mortar wounds of face, eyes and hands. Penetrating wound of right eye with iris prolapse. Excision and conjunctival flap. Aug. 18 hypopyon iritis. Aug. 26 endophthalmitis, painful eye; no P.L. Aug. 27 I.M. penicillin and enucleation.	(*a*) August 27, 09.50 hours, 15,000 units I.M. (*b*) 10.20 hours, 15,000 units (*c*) Enucleation 11.30 hours	(*a*) Not applicable (*b*) One hour after last dose	A. No inhibition V. Sterile 48 hours aerobic culture	—
8a	Pte. F. ...	B.	Wounded Aug. 3. Box mine caused penetrating wounds of left eye, hands and face. Aug. 3 excision of iris, prolapse and conjunctival flap. Aug. 7 endophthalmitis. Aug. 27 enucleation	Nil. Enucleation 12.30 hours	13.30 hours	Forty-eight hour culture sterile. Assay nil. Control at same time as 7a	—

Next, the tubes were incubated for 6 hours and then subcultured to fresh plates which had been divided into squares. One square had a control culture of S. aureus growing whereas in others the dilution of the substance in question containing the known number of organisms: (Diagram No. 5).

The inhibitions at any dilution could thus be noted.

The results are classified as follows:—

(1) In normal eyes.

(2) In wounded eyes, *i.e.*, scleral rupture, haemophthalmos.

In both types of eyes, the aqueous was withdrawn by a fine hypodermic needle: the vitreous was obtained by a scleral incision and the insertion of a small sterile test tube into the wound.

Normal eyes were obtained from patients who had died of wounds with no ocular involvement: abnormal eyes had lesions such as avulsion of the optic nerve, haemorrhagic glaucoma (haemophthalmos) phthisis, bulbi, etc.

Analysis of results

(1) Five normal eyes were removed as speedily as possible after death from patients who had received intramuscular penicillin, the aqueous and vitreous humours were subjected to penicillin assay immediately. There were two control eyes.

(2) Seven eyes with abnormality of trauma or infection were examined for penicillin immediately after enucleation. There was one control eye.

(3) Both groups had received intramuscular penicillin before death or before enucleation at the times stated.

In Group 1 of normal eyes, the average time of assay was carried out 6½ hours after death, and 14 hours after administration of the last dose (9 hours if Case No. 1 is excluded). These intervals must be regarded as too long; speed of collection was necessarily limited by practical considerations. No inhibition of bacterial growth by the ocular media from any of these cases was detected by the tests used. In order to exclude the presence of a natural inhibitory substance in the ocular media two control cases which had received no penicillin were tested; these also gave negative results and no bacterial inhibition.

In Group 2 which was composed of damaged eyes, the rate of collection was better as the ocular media could be examined much closer to the time after the last dose of penicillin had been given. The average time of examination after this dose was therefore much shorter even to half an hour in two cases.

Conclusion

From these experiments and controls it appeared that when penicillin was injected intramuscularly it did not readily pass into

the humours of the eyes nor in such quantities that it was detectable by the tests described. It can of course be argued that the tests employed such dilutions that they were not sufficiently sensitive and that the time interval after collection was too long. On the other hand, however, if the penicillin was present in such minute amounts the prospects of controlling such gross infections as occurred within the eye, when penicillin was administered therapeutically by this route, did not appear to be very bright. Such later was found to be the case.

In view of the disappointing results of general penicillin therapy, it remained to investigate the local effect of the direct injection of penicillin into the aqueous and vitreous humours of infected eyes.

Technique of aspiration and Penicillin replacement.—These injections were all carried out under pentothal anaesthesia using sodium penicillin solution (1,000 units per minim of distilled water). The aqueous or vitreous fluid withdrawn was subjected to 48 hours aerobic culture in every case and was always found to be sterile. No general effects were noted as a result of these injections: local effects in one case were an increase of pain accompanied by conjunctival oedema. It is possible that tension alterations might cause pain if more than two minims of fluid are withdrawn and replaced, or if the manoeuvre is not executed very slowly.

Aqueous humour.—No antiseptics were used in the conjunctival sacs for twenty-four hours prior to aspiration. After a small incision had been made into the cornea with the point of a broad needle, a fine hypodermic needle (23 S.W.G. 1 in. long) mounted on a 2 c.c. all glass syringe was inserted obliquely into the anterior chamber. Usually the intra-ocular pressure forced the plunger up and two minims of turbid aqueous were withdrawn. The syringe was quickly changed leaving the needle in position and a second syringe attached by means of which two minims of penicillin solution (2,000 units) were injected very slowly into the anterior chamber. The needle was then quickly withdrawn and the anterior chamber retained: the brown penicillin solution could be seen mixing with the turbid aqueous. The aqueous fluid in the first syringe was despatched immediately for culture.

Vitreous humour.—In order to avoid conjunctival contamination a small conjunctival flap was reflected between the external and inferior recti muscles. After the sclera had been partially incised, a hypodermic needle was passed into the vitreous chamber pointing upwards, backwards, and inwards for a distance of about a quarter of an inch, depending on the site of the exudate, and at a point approximately ten millimetres from the limbus. Generally light suction was necessary to extract fluid: in one case it was

impossible. Replacement by penicillin solution of the same strength as described was done by change of syringes and the procedure completed by replacement of the conjunctival flap.

Cases

In the present series of cases described, the need for injection of penicillin into the anterior chamber has not arisen so frequently as it has in the case of the vitreous chamber since the anterior chamber is more readily cleared of exudate by a combination of sulpha therapy and protein shock.

In Case 1c the hypopyon actually reformed and increased after being partially aspirated and replaced by penicillin solution: there was no improvement. Improvement was marked after sulphonamide therapy: no protein shock was given.

The outstanding feature of Case 2c was the purulent infiltration in the deep stroma of the cornea which originated from stone particles. In spite of a susceptible organism, penicillin as powder in the conjunctival sac and as solution in the anterior chamber failed to control the infection which went on to general involvement of almost the entire cornea. Protein shock initiated an improvement which Saemisch sections completed. Sulphonamide therapy had no striking effect.

Case 3c showed the beneficial effect of shock therapy by typhoid vaccine on the hypopyon: this is by no means uncommon. It looked as if the hypopyon disappeared from the anterior chamber only to appear in the posterior chamber at the far end of the penetrating wound. Here again culture of the vitreous was sterile and no form of therapy controlled the deep infection.

Case 4c was an example showing the intravitreous use of penicillin combined with the removal of an intra-ocular body eight days after wounding. The eye settled quickly probably due far more to the removal of the foreign body and the natural resistance of a Ghurkha than to the penicillin therapy.

Case 5c was a case of severe infection almost amounting to panophthalmitis. A large dose of penicillin was injected into the turbid yellow vitreous with no improvement. Two days later when the eye was removed and the vitreous subjected to penicillin assay a high concentration of penicillin still remained.

Case 6c showed gross involvement of the vitreous chamber but maintained a steady downward progress to painless shrinkage of both eyes. The vitreous culture was sterile, and all along the inflammatory reaction of the eyes was not marked.

Case 7c is parallel to Case 4c. After removal of the foreign body the eye settled, but the intravitreous injection of penicillin had no influence on the spread of the exudate afterwards.

These two cases also probably benefited to some extent by the drainage through a posterior sclerotomy incision.

No.	Name	Nat.	History	Penicillin	Cultures	Assay	Comment
1c	Pte. M. ...	B.	Wounded June 22 when a house in which he was hiding was struck by a shell. A splinter entered the right eye: no other serious injuries. Pen. central corneal wound. June 22. Giant magnet extraction of 1·0 F.B. by post. route—no penicillin applied. June 24. Hypopyon: yellow lens flocculi: yellow retro-lenticular reflex. June 25. Course of I.M. penicillin half-million units completed. June 26. No appreciable improvement. 3 mm. hypopyon and yellow lens flocculi remain. Aqueous aspirations: 2 minims. 30,000 units Sod. Pen. in 2 min. dist. water injected. A.C. not lost. June 27. Further increase in hypopyon, no undue reaction: no pain and no improvement. June 28. Full course of sulphathiazole. July 1. Oedema less. Much better. August 9. Eye white post caps. synechiae. Opaque lens. P.L. accurate. V. C.F. August 16. Lens discission. August 20. No undue post-operative reaction. September 27. Eye white and quiet.	(*a*) June 25. Course of 15,000 units 3 hourly I.M. H.Bs atropine, etc. Total course 500,000 units. No clinical improvement. (*b*) June 26. Aqueous injection of 30,000 units. No clinical improvement. In this early case a high penicillin concentration was obtained in the A.C. but there was no undue reaction.	June 26. Aqueous humour—negative (aerobic 48 hours.	June 26. Aq., no inhibition during I.M. course.	(*a*) No improvement after I.M. and A.C. penicillin. (*b*) T.A.B. shock deliberately withheld. (*c*) Improvement after sulphathiazole course
2c	Sgt. B. ...	B.	Wounded June 27 by Schu mine. Severe lacerations of lids: penetrating wounds of both eyes: multiple stone foreign bodies and gross infection of the left eye. Blast oedema of lids made examination at this stage impossible.				

No.	Name	Nat.	History	Penicillin	Cultures	Assay	Comment
2c	Sgt. B. ... (*cont.*)	B.	June 29. The disintegrated eye had been previously removed. The left eye showed a cornea peppered to all depths with stone particles around which purulent exudate was forming. Culture S. aureus haemolyticus. X-ray: no radio opaque intra-ocular foreign bodies in either eye. Full course sulphathiazole: local application of penicillin powder and ung. atropine half per cent. every three hours. July 10. Corneal infection completely uncontrolled. Steady extension of deep purulent corneal infiltration: hypopyon formed and dimly seen. Local penicillin powder does not appear to be effective. July 13. Aspiration replacement of 2000 units Sod. Penicillin in anterior chamber. Aqueous culture. July 20. No improvement: diffuse yellow infiltration of entire cornea, almost total hypopyon: paracentesis. July 21. Seventy-five million T.A.B. intravenous injection. T. 102°. Paracentesis re-opened. July 28. Oedema of lids and conjunctiva less but corneal condition no better. August 8. Saemisch section and evacuation of turbid aqueous. August 17. Saemisch section repeated. August 19. 100 million T.A.B. vaccine intravenously. T. 101°. August 21. The local inflammation in the eye showed signs of improvement following the second Saemisch section.	(*a*) Local Pulv. penicillin 3 hourly into conjunctival sac. (*b*) Aspiration replacement of 2,000 units sod. penicillin in anterior chamber.	Aqueous 48 hour aerobic—sterile.	Not applicable	No undue pain First signs of general improvement. Corneal condition subsiding. Saemisch section initiated the improvement. (*a*) Gross conjunctival and corneal infection by S. Aureus haemolyticus not controlled by penicillin

No.	Name	Nat.	History	Penicillin	Cultures	Assay	Comment
2c	Sgt. B. ... (*cont.*)	B.	September 11. The cornea was healed and showed deep scarring in the lower half: the upper and outer quadrant was clear. Linear scars of the Saemisch sections were not unduly dense. The anterior chamber was reformed: anterior synechiae were present but not easily seen. Iris and lens details not discernible. Projection brisk and accurate. Vision: P.L. to gross hand movements. Tension: definitely plus. Case evacuated to U.K.				(*b*) Improvement due to T.A.B. therapy and Saemisch sections. (*c*) In spite of heavy corneal infection, the aqueous culture was sterile
3c	Cpt. S. ...	I.	August 8. Walked into barbed wire at night and received a penetrating wound of the right eye. August 10. Infected penetrating wound of cornea: 2 mm. hypopyon; iritis; local lens changes. V. H.M. Full course of sulphathiazole. August 12. Hypopyon increasing. 50 million T.A.B. shock. T. 101·8° F. August 16. Eye improving: hypopyon less, lens cloudy: retro-lenticular yellow exudate appearing in vitreous behind site of penetration. 75 million T.A.B. shock. T. 101° F. August 18. No hypopyon: yellow vitreous reflex increasing: exudate now clearly seen. Very poor projection. August 27. I.M. course of penicillin 500,000 units. August 31. No sign of improvement. Vitreous exudation now very extensive and projection very poor. September 10. Intravitreous penicillin injection. Vitreous aspiration and culture. September 11. Severe ocular pain: increase in conjunctival oedema.	August 27. I.M. course of penicillin. 15,000 units 3 hourly. September 10. Intravitreous injection 2,000 units sod. penicillin.	48 hour aerobic vitreous culture negative		(*a*) The hypopyon in the anterior chamber dispersed as a

No.	Name	Nat.	History	Penicillin	Cultures	Assay	Comment
			September 11. Severe ocular pain: increase in conjunctival oedema.	2,000 units sod. penicillin.	negative		(*a*) The hypopyon in the anterior chamber dispersed as a
3c	Cpl. S. ... (*cont.*)	I.	September 26. Local inflammation has subsided: cornea bright: A.C. clear, post. synechiae: local lens opacity: general canary-yellow vitreous reflex: V. P.L. T. soft. October 5. Enucleation. Implantation of Perspex ball in Tenon's capsule.				result of shock therapy. (*b*) General I.M. penicillin caused no improvement. (*c*) Vitreous culture sterile.
4c	Spr. N. ...	I.	August 29. Wounded by the accidental explosion of a Mills grenade. Penetrating wound of the left eye, neck and right thigh. August 31. Penetrating scleral wound of left eye. Explored and covered by conjunctival flap at Indian C.C.S. September 5. Acute iritis; local lens changes; yellow vitreous reflex. V. no P.L. X-ray: radio opaque intra-ocular foreign body. September 6. Vitreous aspiration for culture. Infero lateral posterior sclerotomy. Haab extraction of steel foreign body; escape of turbid fluid. 2000 units of penicillin were injected through the scleral incision and appeared to be retained. September 23. Normal convalescence; the eye settled and became white but the yellow vitreous reflex persisted. Tension normal to soft, and vision no P.L.	September 6. Intravitreous injection 2,000 units penicillin.	48 hours culture—aerobic. (*a*) Vitreous—sterile. (*b*) foreign body—sterile.		The eye settled after removal of the foreign body and injection of penicillin. Such a result, however, is common after such operations without penicillin. The vitreous exudation was not noticeably affected.

No.	Name	Nat.	History	Penicillin	Culture	Assay	Comment
5c	Pte. M. ...	Maori	August 2. Wounded by shell fragment. Penetrating corneal wound of right eye; large prolapse of iris and traumatic cataract. Conjunctival vizor flap *in situ*. Large intraocular foreign body removed at Mobile unit. August 8. Retraction of flap; acute iritis; lens cloudy; gross infection of vitreous. August 9. Intra vitreous penicillin injection. August 11. Condition worse. Severe pain and no perception of light. Enucleation. Vitreous assay.	August 9. Intra vitreous injection of 5,000 units sod. penicillin.	Aerobic 48 hours —vitreous culture negative.	Assay of vitreous showed high concentration of penicillin.	(*a*) Severe infection of vitreous. (*b*) Penicillin was found in vitreous after injection. (*c*) No benefit from intra-vitreous injection. (*d*) Vitreous culture sterile.
6c	Gdsn. W.	B.	July 28. Wounded by Schu mine. Pepper wounds of face; penetrating wounds of both eyes. No other serious injury. The sclera of the right eye had been ruptured, sutured and covered by vizor flap. The left eye had a corneal wound with iris prolapse. Excision of prolapse; removal of stone foreign bodies in iris; vizor flap. August 9. Both eyes settling; stitches out; flaps retracting. Full course of sulphonamide. There was canary-yellow reflex of the vitreous in both eyes. R. V. P.L. L. V. no P.L. August 17. No improvement in yellow reflex although eyes were whitening. R. eye: vitreous aspiration and injection of penicillin.	Right eye. 2,000 units intra vitreous injection.	48 hour aerobic vitreous culture sterile.		(*a*) No improvement from sulpha or penicillin therapy. (*b*) Both eyes improved a little after shock therapy. (*c*) Although

No.	Name	Nat.	History	Penicillin	Culture	Assay	Comment
6c	Gdsn. W. (*cont.*)	B.	August 20. No undue effects and no improvement as a result of the intra-vitreous injection. 75 million T.A.B. shock. T. 102·8° F. September 13. Both eyes quiet and white. Extensive infiltration by yellow exudate in both vitreous chambers. Tension soft in both eyes. Total blindness.				both eyes appeared alike there was no appreciable difference as a result of intra-vitreous penicillin injection of one eye.
7c	Sgt. T. ...	B.	September 5. Wounded by splinter when shell struck his tank turret. Limbal penetrating wound of left eye. September 7. Excision of prolapse; vizor flap at Mobile unit. September 16. Acute iritis; clear lens, canary-yellow vitreous exudate. X-ray: single radio opaque intra-ocular foreign body. Posterior sclerotomy and Haab removal. 2000 units of penicillin injected into vitreous through scleral incision. October 8. Left eye quiet and white. Diffuse yellow reflex behind the lens infiltrating the vitreous. This appears to have increased since the operation. Tension, soft. Vision, faint P.L. October 21. Left eye painful and irritable, globe shrinking rapidly. Vision, no P.L. Enucleation and implantation of Perspex globe.	Intra vitreous injection of 2,000 units of penicillin.	(*a*) Vitreous—sterile. (*b*) Foreign body—sterile.		No improvement as a result of intra-vitreous penicillin injection.

(5) *Surgical treatment.*—It is not intended here to add refinements of surgical technique to those descriptions already published by experienced military ophthalmologists, but rather to draw attention to an old operation which can play an important part particularly in corneal lesions resulting from Schu mines.

If the diffuse purulent infiltration throughout the substantia propria of the cornea is allowed to persist the eventual physiological impairment of vision from deep scar tissue will certainly be great. Drastic measures aiming to bring about speedy resolution are indicated.

The removal of one or two stone foreign bodies and the application of pure carbolic acid has no influence on the deeper infiltration. Nor is it possible to curette because the infiltration has spread in every direction amongst the interstices of the corneal tissue. Also, the actual cautery would leave far too dense a scar if it had to be applied to eliminate such an infection.

Corneal section after the manner of Saemisch has proved of value in these desperate cases. The section should be made once or twice through the area of deepest infiltration and the length of section should be adequate in order to evacuate the sticky hypopyon which so frequently co-exists.

No fears need be entertained as to the final density of the scar or the risk of broad anterior synechiae.

Time and again this operation has proved of value when paracentesis, without opening the actual area of infiltration, has not been satisfactory.

Summary

(1) An account of clinical experiments and methods of treatment to control deep intra-ocular infection in battle casualties is rendered. This work has been carried out under conditions of active service.

(2) To control deep intra-ocular infection in warfare the following measures are recommended :—

(*a*) The adoption of the Anti-Mine vizor particularly for selected troops likely to encounter Schu mines. This has been proved to be practicable.

(*b*) Simple cleansing measures of eye wounds by general surgeons at F.S.U. level.

(*c*) The employment of expert ophthalmic surgeons and adequate equipment as far forward as possible thus reducing time lag after wounding, and ensuring the early extraction of intra-ocular foreign bodies with sealing of the penetrating wound.

(*d*) Routine insufflation of penicillin powder at an early stage into all wounds of the eye: sterilisation of the conjunctiva by penicillin must be considered as established fact.

(*e*) Air evacuation to Base ophthalmic wings.

(*f*) Sulphonamide therapy and protein shock.

(*g*) Saemisch section in selected cases.

(3) It appears from these clinical experiments, but it cannot be considered to be proven that (*a*) penicillin does not enter the ocular media when given by intramuscular injection.

(*b*) That such therapeutic injections do not influence the course of deep infections of the eye.

(*c*) That the eye will tolerate and retain large concentrations of penicillin when injected into the media but that such concentrations do not control deep infection thereof.

(*d*) The value of penicillin in the control of deep intra-ocular infection must therefore be in prevention rather than in cure: hence it should be used as a local application as soon as possible after the eye is wounded.

(4) It is suggested that since the exudates of the anterior chamber and of the vitreous chamber are consistently sterile as well as the intra-ocular foreign bodies, they should be designated "anterior" hypopyon and "posterior" hypopyon respectively since they have an identical pathology.

In conclusion this work must be taken to express many of the thoughts, verbal and written, of the team of ophthalmologists of this Force who have been too busily occupied recently to publish them. As a member of that team I am privileged to carry out that duty for them, in the hope that they may be of some value to our colleagues in other Theatres. The Army pathologists, as ever, have been most helpful, particularly Majors Facey and Cunningham. Brigadier Sir Stewart Duke-Elder has seen to it that we always had the "tools" and there has been no lack of equipment with which to do the job. Pte. Mervyn Suart, ophthalmic artist at a Base ophthalmic wing has kindly provided the drawings.

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THE OCULAR MANIFESTATIONS OF HYSTERIA IN RELATION TO FLYING*

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IT may be stated at the outset that neurosis in any member of aircrew is relatively uncommon. This is largely due to careful administrative selection, rigorous medical standards, and the weeding-out process that takes place throughout flying training. Air Commodore Livingston has formulated the standards for visual fitness for aircrew duties in the present war, and his standards have been accepted as the criteria of normality.

It is not surprising that a few potentially unstable individuals pass this filter, sometimes suppressing at their time of entry information which, if divulged, would have led to their rejection. It is chiefly this small group of misfits who subsequently break down under conditions of stress. The peculiar nature of flying duties throws particular strains upon the whole visual apparatus. Over a period of three years occupied in regular neuropsychiatric examination of aircrew we have collected a series of 40 cases of ocular manifestations of hysteria. In ophthalmological textbooks little space is devoted to this subject. The common manifestations of hysterical blindness, hysterical contraction of the visual fields, and glare asthenopia are well recognised. Traquair[1] (1942) has fully described the field changes in neurasthenia and in hysteria and his work must be consulted for reference to bizarre visual field findings, including some forms of ring scotomata in hysteria. Hurst[2] (1940) has made reference to defective accommodation-convergence in neurotic soldiers. A recent paper by Michaelson[3] (1943) describes manifestations found in soldiers in the Middle East. More recently the matter has been the subject of discussion at the Royal Society of Medicine[4] (1944).

It is understandable that in pilots and other members of aircrews manifestations of hysteria should affect the eyes rather than the limbs, for what his legs are to an infantryman, his eyes are to a pilot. Aircrew duties involve searching the ground and sky by day and night, exerting a constant vigilance over dials and instruments of precision, the transference of attention from the instrument panel to the horizon, and making judgments in conditions of varying visibility. The eyes are subjected to glare from the sun

* Received for publication, December 8, 1944.

and from the sea, and sudden blinding by searchlights or by lightning flash. These stresses on the visual apparatus are doubtless responsible for the rich variety of clinical pictures presented in aircrew. Nothing comparable to this is seen in civil practice with perhaps the exception of compensation cases following upon head injury, and in certain types of miners' nystagmus. The disorders which are described are not those of seeing, but of looking; they are disorders of higher cerebral functions. As Traquair says, " The interference is with the will of the patient, and such functions as perception, appreciation, attention and response are involved; in other words, it is the patient who is at fault, and not his visual mechanism."

Visual aberrations experienced by normal aircrew

Under conditions of fatigue, anoxia and anxious preoccupation certain visual aberrations may be noted in normal individuals.

Certain individuals engaged for long hours in flying on instruments describe what they call " *fatigue spells*." They say that the instrument panel becomes blurred or may appear to oscillate for a few seconds whilst they become momentarily dazed. The condition is usually rectified by shifting the gaze and shaking the head or rubbing the eyes.

The effects of *anoxia* on vision, particularly night vision, are well known. At 16,000 feet the rate of adaptation decreases considerably, and there is an average percentage decrease in the range of night vision of 40 per cent., if oxygen is not used. Under conditions of anoxia almost all subjective ocular symptoms may occur. Members of aircrew who delay turning on their oxygen supply at night and commence to use it above 10,000 feet may experience nausea, and either a sudden brightening or a rose-red clouding of the visual field. These visual sensations last two minutes at the most, until the oxygen debt has been paid off.

Visual *after-sensations* may be noted in conditions of anxious preoccupation. Thus when crossing a coastline after flying over the sea for long hours a vision of the waves may appear between the pilot and the land. This after-lag is like the main sensation, only weaker, and rarely persists for more than a few seconds.

Diplopia may sometimes be experienced. When the eyes of a normal individual are directed upon a near point, more distant objects are seen double. When the eyes are directed to a distant point, nearer objects are seen double. (This can be demonstrated by holding a pencil a foot in front of the eyes in line with a distant object.)

This paper however is not concerned with physiological phenomena found in normal individuals, and they are mentioned here only that they may be distinguished from grosser, more persistent and more disabling phenomena due to neurosis.

Cases of hysteria and of affective disorder compared

The majority of our cases of psychoneurosis have shown a mixed reaction type, but in most one reaction has predominated. This paper deals mainly with cases of hysteria, and in particular with a series of forty. Cases of hysteria and of affective disorder generally show differences in their ocular symptoms and signs. In our experience, about one-fifth of cases of hysteria, but only about one-tenth of cases of affective disorder, have complained of visual symptoms. In the cases of hysteria the visual complaints, when they existed, have almost always been the primary and disabling symptom: in the cases of affective disorder they have constituted one symptom of many, not in itself disabling. On the other hand, it certainly happens that cases whose initial hysterical symptoms have not been ocular, develop ocular symptoms and signs as the result of the suggestions implicit in close questioning and examination: and ocular symptoms occasionally are developed as a last resource of evasion, when no organic basis has been found for other symptoms and the individual faces the prospect of a return to duty. The symptomatology also of the two conditions is somewhat different. Of those with visual complaints, one-half of the cases of affective disorder complained of aching eyes, while only one-tenth of the cases of hysteria did: and blurring of vision, a disabling symptom usually, has been twice as common in cases of hysteria. These distinctions are of some diagnostic value.

The ocular symptomatology of hysteria

The symptoms presented by these cases are similar to those complained of by patients with organic ocular defects and diseases, with few exceptions when the symptoms are unusual and may be expressed in bizarre terms. A list of the symptoms complained of in the 40 cases under review are presented in the table in order of frequency. Complaints of extra-ocular symptoms of which the commonest is headache have not been included. The 40 cases comprised 23 pilots, 10 gunners and 7 observers.

Table of Symptoms.

Blurred vision	19
Photophobia	15
Diplopia	11
Defective night vision	10
Visual hallucinations	6
Lacrymation	5
Intermittent visual failure with amnesia ...	5
Aching eyes	4

Difficulty in judging distances	4
Blepharospasm	2
Looking past objects	1
Intermittent loss of vision in one eye ...	1
Film over one eye	1
Involuntary movement of one eye ...	1
Jumbling of print	1
Failing day vision	1

Characteristically, the symptoms are disabling considered in the setting of the duties which the individual has to perform. Thus those engaged in night flying may complain of failing night vision; those who have to watch dials continuously, of intermittent visual failure. The symptoms as expressed may indicate that the individual's eyes have become so unreliable that when flying in formation or with a crew he could no longer be considered to be a reliable person. Intermittency of the disabling symptom is sometimes a feature.

The symptoms are out of proportion to any ocular disability which may be present. If a refractive error or phoria is found, it is always insufficient to account fully for the degree of discomfort or disability experienced by the individual, or for the number and variety of the symptoms which he presents. Thus an instructor who had flown 2,500 hours complained of photophobia, headaches, recent failure of vision by day and night, and constant lacrymation, and showed no significant ocular abnormality. He had one prism dioptre of exophoria, and was emmetropic.

The disability may be stated in terms of performance rather than of symptoms, the patient complaining that he is no longer able to judge distances when flying in formation or when coming in to land. Or an individual who has damaged an aircraft in a faulty landing may attribute his poor performance to an ocular defect. In such cases there is an uncertain distinction from malingering. On the other hand, we have noted that the hysterical response to stress is not infrequently delayed.

Not all of these patients were free from anxiety; most, however, were placid, or gave a superficial impression of quiet confidence.

In nearly every case reference was first made to an ophthalmologist, and when the visual findings were discovered to be within normal limits or when the disproportion between symptoms and signs was noticed, the case was then referred to a psychiatrist. No case was accepted as hysterical unless positive evidence of psychoneurosis could be demonstrated on psychiatric examination.

The following visual hallucinations were noted: approach (in focus) of objects in the upper parts of the visual fields; hairs of light around objects and wavy oscillations of the tops and bottoms

of mountains; oscillation of the moon; seeing coastlines that did not exist, on a clear day; bubbles in front of the eyes; flashes of red light. Three cases of micropsia also came under review, but are not included in this series. These were of considerable interest as micropsia is characteristic of organic, particularly toxic or confusional, states. In two pilots who had this symptom the complaint was that everything was seen a long way away, as if through the wrong end of a telescope. One of these patients had as many as 4-5 attacks of this a day, each attack lasting from 5-60 minutes. In one case it was associated with a feeling as if his tongue and body generally were becoming enlarged. The onset of the symptoms in both was during flying training, but in one case there had been a previous micropsia during a febrile illness in childhood. In another case, in an air gunner, the symptoms were noticed only in artificial light. All of these patients were of markedly neurotic constitution, but the presence of an organic basis for their symptom could not be confidently excluded, as they were not under prolonged observation.

A not inconsiderable group of cases of migraine syndrome with visual disturbances in association with affective disorder, have been excluded from this survey.

Five cases complained of intermittent visual failure with transient amnesia. The opinion formed, after detailed investigation, was that the amnesia was of hysterical and not of epileptic origin. Three of the cases of temporary blindness occurred on the ground, the attacks lasting as long as 45 minutes: during this period the individual had to be led about by a companion.

The objective findings on examination

Any of the functional components of the eyes may be affected, and changes may be seen in striped and unstriped muscle, glands and blood vessels. On examination, blinking, coarse tremor of the closed eyelids, and blepharospasm are common. Suffusion of the conjunctivae and lacrymation may be present. Inconsistencies and variabilities are commonly noted by the examiner in the course of routine testing or on repeated examination. On testing the conjugate movements of the eyes the movements of the examiner's finger are frequently anticipated, the ocular movements are poorly controlled and fixation is not maintained. Nystagmoid jerkings may be noted. All degrees of heterophoria are found (11 out of 40 cases). There may be variable frank squint, with or without diplopia. The psychological disorder may render manifest a latent squint with associated diplopia. In cases of concomitant squint, the psychological disorder may cause an image previously suppressed to become obtrusive. Two of our cases showed an alternating neglect. More than a quarter

showed a convergence weakness (*i.e.*, convergence not achieved closer than 10 cms.), and convergence may at first be absent on examination and later achieved by persuasion. The individual may converge better on his own finger than on the examiner's. Most curious are dissociations between convergence of the visual axes and contraction of the pupils: thus one may find convergence without pupillary contraction, or exceedingly rarely pupillary contraction without convergence. Variable convergence spasm may be present, the eyes tending to converge at rest, or there may be spasm of accommodation: a case of each occurred in this series. The most bizarre signs are demonstrated by "ocular gymnasts," who have the capacity for independent movement of the eyes: thus one subject could fix with his right eye and adduct his left strongly towards the midline.

The behaviour of the subject during examination is most notable. He is usually ill at ease. His replies are inconsistent and evasive. He has various mannerisms—the persistent wearing of dark glasses, the pained passing of his hand over his eyes and back over his head, tilting of his head, and rearing of his head when attempting convergence. The latter may be associated with lid retraction. The ocular signs may be altered or abolished by suggestion and persuasion, but this, though highly characteristic, is not pathognomonic of hysterical visual disorder.

Ordinary tests of night vision are of little value in hysteria, as the tests are subjective, and if the individual is unwilling to see he will not see. By the use of an adaptometer, however, in which the intensity of light may be varied quickly, it may be possible to detect inconsistencies in the replies of hysterical subjects or malingerers. Those who complain of defective night vision will almost certainly, on testing, give results indicating low capacity. But provided that there is no ocular abnormality discoverable on examination, and the individual does not give a history suggestive of constitutional night blindness (which is a very rare condition), it may be confidently assumed that failing night vision is not due to organic disease.

The only case of hysterical contraction of the visual fields, perhaps the commonest hysterical ocular finding in civil practice, was noted in an individual who complained of failing vision before he ever started to learn to fly.

Minor refractive errors, phorias or minor degrees of blepharitis were present in some of the cases. It is possible, however, to state that in all cases the findings on physical examination came within the limits of the standards laid down by Air Ministry for fitness for aircrew duties. From the physical standpoint these men were fit for the exacting visual requirements of aircrew.

Two illustrative case histories

(1) Squadron-Leader A., D.F.C., Bomber Pilot. Towards the end of a completed tour of night sorties he began to suspect that he was suffering from eyestrain, and experienced blinding headaches. He consulted a civil ophthalmologist privately as he feared he might be taken off flying, and it is not known what he was told. He completed his tour and was decorated.

On subsequent non-operational flying he complained of photophobia and began to wear dark glasses. He was posted to a squadron for further operational flying but began to make high and erratic landings (after 1,000 hours' flying experience), and reported sick with transient attacks of double vision.

Examination on April 26, 1941, showed that his visual acuity in each eye tested separately was 6/6; convergence was poorly sustained and the effort was stated to cause pain; his conjunctivae were suffused; the ocular findings were otherwise normal, but later in the examination his visual acuity with both eyes tested together was noted to be 6/24. On June 9, 1941, his visual acuity was 6/18 in each eye and it was noted "vision will not correct to 6/6, no reason found." His diplopia recurred and it was then suspected that he had disseminated sclerosis, but neurological examination showed no abnormality; and the inconsistencies and incompatibilities of the ocular findings could not be explained on organic grounds. He was seen by Air Commodore Livingston, who referred him for psychiatric examination.

Comment: This case illustrates well the characteristic ocular findings in hysteria, and the influence of suggestion in producing variations and inconsistencies on repeated examinations. The latent period in the development of signs and their time relationship to stress of operational flying are important. It would have been easy but incorrect to ascribe this officer's symptoms to fatigue, but for six months before he came under observation his flying duties had not been arduous.

(2) Sergeant B., Fighter Pilot. After 100 operational hours in Malta he was invalided home with eye symptoms, with a report from his O.C. which described him as very keen. He stated that he had felt perfectly fit apart from intolerance of light, lacrymation and bi-temporal pressure headaches. These symptoms did not interfere with his flying except when he had to fly above 20,000 feet and keep constant look-out in conditions of bright sunshine.

On examination he showed mild conjunctival injection, visual acuity was 6/5 in each eye, objective convergence = 8 cms., accommodation = 14 cms.; he had 0·5 prism dioptre of hyperphoria in the right eye and 1·5 prism dioptres of esophoria in the left. Five months later his visual acuity was 6/6 in each eye, convergence = 7 cms., accommodation = 12 cms., and he showed

one dioptre of manifest hypermetropia. Ocularly he was fit for full operational category but his symptoms remained. He was then referred for psychiatric examination.

It was found that he had had neurotic visual symptoms before entry which entailed his giving up studying for an examination. The recurrence of his symptoms dated from severe operational stress in Malta, of which he had previously made light.

Comment: It is to be observed that the neurotic nature of his complaint was not suspected on the squadron as he displayed no anxiety or lack of keenness to fly. The variation in the ocular findings and their ultimate disappearance with persistence of the symptoms is important. The symptoms as stated were subjectively a disability for his operational duties, which involved flying at 30,000 feet and keeping constant look-out for enemy aircraft likely to attack out of the sun.

The relationship of neurotic manifestations to inherent ocular defects

We do not subscribe to the view that all heterophorias and defects of ocular convergence are of psychological origin. These findings do exist as inherent ocular defects in people of stable nervous constitution. Some individuals have never fully acquired the ability to converge their eyes; they may never have had to use their eyes for close work. A convergence defect may exist associated with a considerable degree of exophoria, or as a result of damage to the oculomotor nuclei. There is, however, in a number of individuals a correlation between the phorias, convergence defects and neurotic constitution. Moreover, a study of our cases indicates that any inherent ocular defect may form the nucleus for an aggregation of hysterical symptoms and signs.

Factors predisposing to the development of ocular symptoms

From those who develop a hysterical reaction it is almost always possible to derive a history of personal neurotic traits or a family history of psychopathy, or both. And a significantly large number of those who develop ocular signs and symptoms of neurosis give a previous personal history of ocular instability or a family history of eye-trouble. Many of these individuals have suffered previously from "eye-strain," have always been sensitive to glare, and have worn spectacles at school. They have a constitutional liability to develop their symptoms. At the same time, it must always be remembered that in war-time, after a severe traumatic experience, individuals of relatively sound personality may develop hysteria.

Certain environmental factors are of aetiological importance: conditioning accidents which the individual has suffered, and situations of what may be termed visual stress. Minor head injury is the commonest of conditioning accidents: eight out of 40 cases attributed their symptoms to this cause. One man developed his symptoms after a minor eye injury and another after he had been momentarily blinded by a lightning flash. It is easy to understand that in the production of visual symptoms the visual strains (sun glare, searchlights, darkness, etc.) to which aircrew personnel are subject are predisposing factors. This aspect of flying under active service conditions we have discussed above.

Aircrew personnel are so well looked after from the point of view of rest, comfort and living conditions generally that, in our opinion, the question of fatigue hardly ever arises. It may, however, be a factor during exceptional periods of stress from continued aerial warfare, or in the case of those engaged in coastal reconnaissance or anti-submarine sweeps entailing long hours of flying over the sea by day and night, frequently at low levels. Individuals who are engaged on routine flying duties over a long period of time, *e.g.*, flying instructors and staff pilots, may find the monotony of their work intolerable. If hysterical symptoms arise it is often all too easy to attribute them to fatigue.

An attempt was made by one of us in examining candidates for aircrew duties to establish a correlation between ocular muscle imbalance and predisposition to psychoneurotic breakdown. Visual standards stricter than those at present officially employed were used in this investigation, and those candidates whose objective convergence was not less than 10 cms., or who showed an exophoria of 4 prism dioptres or more as measured by the Maddox Rod at 6 metres distance, were given a short psychiatric interview—if there had been no other ophthalmic abnormality to account for these findings. Only candidates passed as visually fit for some or all aircrew duties were interviewed. In the interviews factors which are considered to predispose to psychoneurotic breakdown were sought in the biographies of the candidates: neurotic traits were scored and expressed in degrees of disposition—nil, slight, considerable, very considerable, severe.

Ten cases of convergence weakness and 4 cases of exophoria were examined. Of the 10 cases of convergence weakness, 4 were found to be very considerably and 1 severely predisposed to breakdown. Other types of muscular imbalance were not examined; and the investigation has not been completed. The numbers already investigated are of course too small to provide significant evidence, but the positive correlation found seems suggestive and worthy of further investigation with controls. As we have stated above, we subscribe to the view that by no means all cases of ocular muscle imbalance occur in neurotic individuals.

Differential diagnosis

Reference has already been made to the necessity for finding positive evidence of neurosis in all suspect cases. It should also be borne in mind that organic disease may co-exist with neurosis. The most difficult cases are those of convergence insufficiency arising after head injury with possible cerebral contusion or damage to the mid-brain and peri-aqueductal region. During convalescence from cerebral concussion defective convergence of the eyes may be noted as an organic finding with or without other evidences of damage to the oculo-motor nuclei. The symptom may exist in association with paralytic squint or abnormality of pupillary reaction, or as an isolated ocular finding. In the latter case it may be associated with defective attention or abnormal fatigu-ability. When the defective convergence ceases to be an organic finding depends on a variety of factors, particularly (1) the degree of head injury as assessed by the duration of the post-traumatic amnesia or the total picture of neurological damage, (2) the persistence of evidences of ocular or other neurological damage, (3) the personality of the patient and his mental reaction to the total situation. As a hysterical finding it is seen not uncommonly as one of the most persistent signs after moderate head injury in civil compensation cases. It is noteworthy that in some of our cases of defective convergence and of dissociation between ocular convergence and pupillary contraction no history of head injury was obtained.

A few cases referred for symptoms thought to be of neurotic origin were found on careful examination to be suffering from a small lesion in the region of the macula. This was apparent on detailed examination with the ophthalmoscope and careful examination of the central field by means of a scotometer. (Not infrequently a macular retinopathy has been incorrectly diagnosed in the presence of a doubtful objective abnormality only. Group Captain Keith Lyle considers that the essential criteria for diagnosing this condition are the presence of a small absolute or relative scotoma in the region of the fixation spot and an appearance of abnormal pigmentation or atrophy in the macular region in an old case, or the presence of oedema in a case of recent origin.) In one case an individual who certainly had an affective disorder was found to have an infective retinitis. Retinitis pigmentosa and choroiditis are conditions which must be excluded. In another case of affective disorder over-indulgence in alcohol and tobacco led to the development of tobacco amblyopia. A very puzzling case was that of an individual with convergence spasm, saccadé movements of the eyes, and a complaint of double vision and unsteady gait, in whom the suspicion of a pontine lesion arose. In cases without physical signs, migraine and visual Jacksonian attacks may have to be excluded.

Treatment

Treatment may be considered feasible in cases following a severe traumatic experience and in individuals who have a considerable number of flying hours or of operational hours to their credit. At first it is nearly always necessary to alter the environment to suit the person—this may mean temporary grounding, the prescription of daylight flying only, limiting the duration of the flight, or removing the individual from conditions of tropical glare. Return to full flying duties may be expected in a small number of relatively stable individuals. Orthoptic treatment of hysterics is unlikely to be permanently successful, although it has been shown that the suggestive and persuasive effect may carry the individual on for some time.

Acknowledgments.—Our thanks are due to Air Marshal Sir Harold Whittingham, Director-General Medical Services, R.A.F., for permission to publish this paper. We thank also the various R.A.F. Ophthalmic Specialists who referred cases to us, and Group Captain Keith Lyle for his helpful criticism of this paper.

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THE TREATMENT OF TRACHOMA*

With special reference to local sulphonamide therapy

BY

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LONDON

ONE hundred and thirty-one children were admitted to the trachoma block at White Oak Hospital from 1934 till May 10, 1944, when the block was closed owing to the absence of new admissions. Together with some 40 trachomatous children resident at White Oak Hospital in 1934 and some 20 adults treated as in-patients at the L.C.C. trachoma unit for adults at the Eastern Fever Hospital, a series of some 200 patients treated under ideal conditions for continuous observation was available and has

* Received for publication, June 27, 1944.

allowed a certain amount of experimentation in treatment. A standardized and not unsatisfactory management of trachoma has emerged and is the subject of the present communication.

During the earlier stages such classical methods as treatment with the copper sulphate stick and chaulmoogra oil were tried and soon given up. Treatment with Jacobson's solution and tartar emetic proved of no value. Only three procedures of a multitude suggested by the literature on the subject were found helpful before the advent of the sulphonamides; saturated solution of quinine bisulphate, mercury perchloride and trachocid.

Saturated solution of quinine contains about 2 per cent. of the salt in solution. It is a powerful protoplasmic poison and many observers have reported on its value in trachoma. Mercury perchloride has also been advocated extensively and is generally used as a paint ½-2 per cent. solution in glycerine. Trachocid is a proprietary preparation said to contain bee-venom and is (or was) manufactured by the State Serum Institute at Vienna. It was recommended for use by injection into the upper fornix and subconjunctivally at the limbus. Experience at White Oak has fully justified the critical use of these agents.

A large number of classifications of trachoma into different stages has been proposed by different ophthalmologists at different times, MacCallan's classification into four stages with some subdivisions probably being the most widely used. At White Oak, a simple classification based on therapeutic requirements was found helpful. By Stage I was meant active trachoma with sodden fornices and follicle formation. Stage II represented a moist tarsal conjunctiva, ideally without follicle formation and but little swelling of the fornix. Stage III stood for Stage II, but with the conjunctiva no longer moist: it was trachoma in the process of healing. Treatment aimed at the rapid conversion of Stage I into Stage II. The passage of Stage II to Stage III was a more prolonged process.

The advent of the sulphonamides brought a valuable agent in trachoma therapy. At first it was used by oral administration and subsequently by local application. Used in conjunction with other agents in trachoma, the affection need no longer be regarded as a peculiarly chronic condition. Many cases of trachoma can now be rendered non-infectious within three months and be considered clinically cured in about six months.

The management of trachoma cases at White Oak Hospital.— On admission most cases show sodden fornices and follicle formation. The rapid conversion of these appearances into those of Stage II can be effected by the combination of the following procedures.

(1) Administration of full doses of sulphapyridine, sulphathiozole or sulphamezathine (the last being best as it is least toxic) for 10 days.

(2) Mechanical expression of the follicles and the contents of the fornix. Rarely brossage is necessary. Local anaesthesia is adequate for these procedures. If necessary expression is repeated after 7 or 14 days.

(3) The conjunctival surface thus treated is painted immediately with saturated solution of quinine and the paintings repeated three times daily for 7 to 14 days.

These procedures generally ensure a relatively featureless fornix and tarsal conjunctiva within a fortnight. Some follicles there will still be and some infiltration of the fornix, but a characteristic feature of this stage (Stage II) is the moistness of the eye. At this stage any application of copper must be rigorously avoided. Two alternative methods of treatment are open. The more time honoured is the painting of the lids twice daily with glycerine solution of mercury perchloride ½-1 per cent. (in the case of children), or 1-2 per cent. (in adults). The paintings should be continued till the eye becomes dry. In uneventful cases this can be achieved within six months. Where relapses occur, the treatment as indicated for Stage I must be resumed. More recently better results have been obtained by painting the lids with 30 per cent. sodium sulphacetamide solution ("Albucid") once daily and instilling sodium sulphacetamide ointment 6 per cent. (Albucid ointment, 6 per cent.) three times daily. The eye rapidly becomes dry, all follicles disappear and the fornix looks almost normal.

Stage III is characteristically a dry eye. It is not healed trachoma, if scarring is the criterion of healed trachoma. In most cases, nothing need be done, though there is no harm in using Gutt. Cupri Sulphas ¼ per cent., or Gutt. Zinc Sulphas ¼ per cent. The continued use of sulphacetamide ointment is helpful in consolidating the results of treatment.

Scarring is minimal with this treatment—so much so that the writer cannot subscribe to the classical adage "no scarring, no cure." With sulphacetamide treatment, especially, the tarsal conjunctiva remains remarkably supple and shows a pearly tinge.

The treatment of corneal complications.—Pannus is an essential feature of trachoma and regresses with proper management of the conjunctival lesion. Massage with a smooth glass rod of the limbus and upper third of the cornea is, however, a useful procedure and is applied in all cases, especially in Stage II, once daily. Atropine is of course indicated where there is a more active corneal lesion, and a course of oral administration of some sulphonamide may be necessary in such cases.

Before the advent of the sulphonamides trachocid injections subconjunctivally at 2 or 3 points in the circumference of the cornea were found helpful for active corneal lesions and dense pannus. The quantity injected was 0·5 c.c. of the mixed solution obtained in equal amounts from the two complementary ampoules. It has been unobtainable since the outbreak of the war—and may probably be superfluous with present day sulphonamide therapy. Should a corneal ulcer develop, " carbolising " with 30 per cent. sulphacetamide solution may be carried out.

Negative considerations.—The application of the copper stick is a barbarous procedure that should be discarded. Copper, in fact, has little or no place in the modern treatment of trachoma. It does untold damage when applied to the moist eye, and makes a dry eye moist when it is applied.

Summary scheme of treatment.—Stage I. (Follicles and sodden fornix.) General sulphonamide treatment for ten days. Expression. Painting of lids three times daily with saturated solution of quinine bisulphate. (Recently, painting with 30 per cent. sodium sulphacetamide was found as effective.)

Stage II. (Trachomatous chronic conjunctivitis with a non-specific appearance. (A moist eye.)

Painting of lids once daily with ½-2 per cent. mercury perchloride in glycerine.

More recently better results have been obtained by painting with 30 per cent. sodium sulphacetamide once daily and the application three times daily of 6 per cent. sodium sulphacetamide ointment. Corneal massage should be carried out.

Stage III. (Healing trachoma. A dry eye.)

Sodium sulphacetamide ointment 6 per cent. twice daily can be continued until complete clinical cure is obtained.

Alternatively Gutt. Zinc Sulphas ¼ per cent., and less desirably Gutt. Cupri Sulphas ¼ per cent. t.d.s. can be used.

Comments

That sulphonamides are of value in the treatment of trachoma is now widely accepted, though some authorities hold that they are effective on the secondary infection only. Experience at White Oak Hospital, where a number of cases of trachoma have been clinically cured mainly by local sulphonamide therapy, the only adjuvants being one or more courses of general sulphonamide therapy and one or more expressions, strongly suggests that the sulphonamides are indeed specific against the virus of trachoma, and not merely against any associated secondary infection. There is no theoretical reason for doubting this specificity, as the sulphonamides have been shown effective against the viruses allied to the as yet unisolated trachoma virus.

Summary

1. Considerable departures from the classical methods of treatment are now possible in trachoma. The time honoured copper sulphate stick has no place in present day therapy.

2. Expression and the local use of sulphacetamide can in themselves bring about a clinical cure of trachoma.

Valuable supplementary measures are general sulphonamide therapy, local application of saturated solution of quinine bisulphate, mercury perchloride ½-2 per cent. in glycerine, and subconjunctival injections of trachocid.

4. Modern therapy cuts drastically the period of infectivity and the duration of treatment.

A CASE OF MUSTARD GAS KERATITIS TREATED WITH CURETTAGE OF THE CORNEA FOR THE REMOVAL OF A BAND-SHAPED CRYSTALLINE DEPOSIT*

BY

HUMPHREY NEAME

LONDON

OWING to the fact that the cornea of severe cases of mustard gas keratitis is liable to recurring ulceration, it has become customary to regard such corneae as unsuitable for operation. The following case seems worth recording as an example of the fallacy of the opinion mentioned above.

Fred H., aged 56 years, was fitted with contact lenses in 1939 on account of progressive deterioration of vision. In January, 1940, with contact lenses R.V.=6/24, 6/18 (1); L.V. 6/60. In August, 1940, ditto, R.V. 6/18, L.V. 6/60. In April, 1941, ditto, R.V. 6/18, L.V. less than 6/60. In July, 1941, ditto, R.V. 6/24, L.V. 3/60. In November, 1942, ditto, R.V. 6/24. The left cornea showed a transverse band across and below the pupillary area of the cornea composed of a superficial deposit of glistening crystalline appearance completely obstructing the vision.

On November 27, 1942, curettage of the band-shaped opacity was performed under local anaesthesia. Healing of the cornea was uneventful. In May, 1943, with contact lenses, R.V.=6/18, L.V.=6/60, and in November, 1944, R.V.=6/24, 6/18 (3), L.V.=6/36. The patient was very appreciative of the improvement in the vision of the left eye.

* Received for publication December 23, 1944.

ANNOTATIONS

Proof correcting

There seems to be some misapprehension among a certain class of contributors as to the proper use of the proof which is sent out by the printers. It is to give the author the opportunity to see that his paper has been set according to the manuscript and of correcting any misprints. It is not meant as an encouragement to the author to sit down and re-write the whole paper. Every month the Journal has to pay quite a substantial sum for corrections, and if everyone followed the procedure of re-writing his paper on the galley proof we could not afford to keep going.

May we beg those who are good enough to submit papers for publication to see, that when they are sent off, they are ready for the printer? The editors go through each paper and usually correct any obvious defects in spelling, unsplit infinitives, and deal as faithfully as they can with other syntax pitfalls, such as "and which." We do not expect a very high degree of beauty in the prose which is submitted to us. So long as the matter is intelligible there is really no excuse for making a mass of corrections for the sake of English prose. We do not expect a standard such as will be found in the closing sentences of Newman's sermon "on the parting of friends" or in the English liturgy; and perhaps it is just as well we don't.

On Taking Visual Fields

The importance of taking the fields of vision needs no emphasis in these pages. In cases which border between neurology and ophthalmology this is an essential part of the examination, and in purely ophthalmological cases it often yields a surprising amount of information. Many a case of glaucoma simplex has been missed through not taking the field. And there is little excuse for this, for charting the peripheral field does not take very long, especially if one of the newer types of perimeter is used. In the days of our house surgeonship it was a rather more lengthy proceeding. The hospital in which we served used the Priestley Smith model. This had to be found first of all and it was astonishing into what odd places the porters, who got the room ready, were wont to secrete it. After having found the instrument a further search was necessary to get the little bone scale which fitted on to the slot in which the chart was inserted. Then the chart had to be cut out and inserted in the slot, a pin found, the apparatus arranged on a table, the patient seated in front of it and the height adjusted and a piece of paper for the test object cut and inserted in the carrier. We took

many fields and the results of our labours have doubtless gone by now to the pulping machine for salvage. We would put in a word in favour of the Priestley Smith model. It was and is an admirable perimeter and especially handy in mapping the dividing line in cases of hemianopia if one clipped the test object on the arc and worked from the blind to the seeing side. We have not very much to say in favour of the confrontation method, but it is useful as a rough guide for major field defects. If any such are found by this method the field should always be charted on a perimeter. It has been our experience on more than one occasion to hear a patient say, "but Mr. so and so did not examine my eyes with this instrument." Even if the field examination yields no assistance to the diagnosis it sometimes impresses the patient, though perhaps this is adopting a low standard of ophthalmological morality. It will be found useful we think to take visual fields as a routine in examining very aged persons. Their media are frequently far from clear and one may get useful help especially in doubtful cases. The examination of the central parts of the field for scotomata is not included under this heading; it very often yields much more information than a chart of the peripheral field; but it takes time and experience to get consistently satisfactory results.

COUNCIL OF BRITISH OPHTHALMOLOGISTS

Plan for Formation of a Faculty of Ophthalmologists

THERE is obvious need for an authoritative and representative body to guide ophthalmologists through the intricate and important problems which are to be settled in the near future, to represent their interests to the State, and to co-ordinate their efforts, so that in the coming re-orientation of the medical service of the country the greatest good accrues to the people, while at the same time the interests of the profession are preserved. It is generally accepted that, although circumstances may necessitate that changes be gradual, fundamental principles are now being evolved which will profoundly affect the medical profession and the community at large. So far as the ophthalmic services are concerned, the alternative to having policies imposed by others is to establish an authoritative body which will be able to initiate and criticise policy so that the interests both of the profession and the community may be furthered.

The need for a body of this sort became apparent towards the end of the last war, and on the initiative of certain leading ophthalmic surgeons a general meeting of British ophthalmologists

was held on May 2, 1918, at which it was decided to establish a Council of British Ophthalmologists, consisting of the Presidents and Past Presidents of the Ophthalmological Society of the United Kingdom and the Section of Ophthalmology of the Royal Society of Medicine, together with nine members elected annually, four each by the Councils of these bodies and one by the Council of the Oxford Congress. Later the Master and the Past Masters of the Oxford Congress were added as permanent members and the number of elected members increased.

The functions of the Council, as stated in its rules, were "To take cognisance of, and to act in all matters of ophthalmic interest arising in connection with national industries and public services, and to initiate or to advise concerning movements which have for their objects the welfare of the eyesight of the community."

The Council of British Ophthalmologists has done much valuable work in many different fields—political, educational, and scientific; but recently it has been felt that this Council would have more weight and authority if it were more directly representative of the whole body of ophthalmologists in the country.

Some of the immediate problems which require examination and early solution are of great moment. The White Paper outlining the Government's proposals for a National Health Service deals vaguely with an ophthalmic service, although it is clear that it is the Government's intention to establish such a service. It will be the first task of the Faculty to examine the many questions arising in this connection, and its aim, in collaboration with the appropriate Ministries and other bodies concerned, to play an important part in determining the form which this service will take. This raises questions not only of conditions of service, but of the relation of the ophthalmic practitioner to the dispensing and sight-testing opticians, the methods of spectacle supply, the establishment and control of clinics, and so on, all of which are of far-reaching importance. Moreover, the institution of a National Service will raise the issue of the personnel who are to be considered as ophthalmologists, and the regionalisation of Hospital Services will require adequate planning.

In addition to these medico-political matters it is evident that the question of education and research, clinic and hospital policy, industrial problems, and a host of others are to assume importance in the immediate future. It is advisable that the whole body of ophthalmologists should play a part in the institution of such policies as they affect their specialty and be in possession of a mechanism to influence their development. Organisations apart from ophthalmologists are taking an interest in such questions. It would seem of importance that there should be some body more representative than the Council of British Ophthalmologists, as at present constituted, to guide the profession and advise the State.

The Council of British Ophthalmologists have therefore decided to promote the formation of a Faculty of Ophthalmologists.

The functions of the Faculty will be:—

1. To take cognisance of, and to act in, any matters of ophthalmic interest.
2. To encourage suitable standards of education in ophthalmology for undergraduate and postgraduate students.
3. To encourage research in ophthalmology and cognate subjects.
4. To secure such conditions in ophthalmic practice as will attract persons of high professional attainments and afford ample scope for the exercise of their abilities.
5. To maintain a high ethical standard in ophthalmic practice.
6. To act as an authoritative body for the purpose of consultation in matters of public and professional ophthalmic interest.

Constitution of Faculty

The Faculty shall consist of Members and Associates who must be registered Medical practitioners and have the following qualifications:—

Members

Only ophthalmologists of full consultant status shall be eligible for membership. They shall be:—

1. Ophthalmic surgeons to hospitals recognised as schools of ophthalmology by universities or other medical examining bodies.
2. Ophthalmic surgeons other than the above who have been engaged for at least five years in full-time practice as specialists and have charge of beds in voluntary hospitals approved by the Council (at the initiation of the scheme, approved by the C.B.O.). Provisionally, these shall be general hospitals of more than 200 beds and special ophthalmic hospitals of more than 20 beds.
3. Persons no longer on the active staffs of hospitals who have held appointments specified in Classes (1) and (2).
4. Other ophthalmic surgeons of consultant rank approved by the Council, including those in the Services or holding Government appointments.

Associates

Any ophthalmologist who has been for at least two years in full-time practice as a specialist (civilian or Service) shall be eligible for election as an Associate, on application in prescribed form and approval by the Council.

Note.—The above qualifications for Members and Associates are possibly temporary standards which may require revision in case of the establishment of a national grading of consultants and specialists.

Executive Organisation

Executive powers shall be vested in a Council which, for the sake of continuity, shall be known as the Council of British Ophthalmologists. This Council shall consist of 21 members, of whom 15 shall be elected by Members and 6 by Associates of the Faculty.

Officers

The Officers of the Faculty shall be the President, Vice-President, Hon. Secretary and Hon. Treasurer who shall be elected annually by the Council from among its members.

Election to the Council shall be by postal ballot on a national basis, but with provision as follows for regional representation. The electorate will be divided into five regions. In the case of Members, the candidate in each region who receives the highest number of votes in the national ballot shall be deemed elected as the representative of his particular region. Thereafter the remaining seats on the Council shall be filled by those other candidates receiving the highest numbers of votes in the national ballot. In the case of Associates, the candidate in each region receiving the largest number of votes in the national ballot will be deemed elected, except in the London region where the two candidates receiving the highest number of votes will be deemed elected. As there will be five regions all the six seats open to Associate candidates will thus be filled.

One third of the members of the Council shall retire each year. The members of the Council to retire in every year shall be those who have been longest in office, but as between persons who became members of the Council on the same day, those to retire shall be determined by the Council by such method as it shall think fit.

Members of the Council shall be eligible for re-election for a further period of three years, but after the second period of three years shall be eligible only after a lapse of one year.

The Council shall call an annual general meeting of the Faculty to receive and discuss its report. Any Member or Associate of the Faculty shall have the right to bring up for discussion at the annual meeting, after giving due notice to the Secretary, any subject within the province of the Faculty.

The Council shall have the power to call a special general meeting of the Faculty at any time in case of need.

Standing Committees. The Council shall appoint standing committees to deal with certain branches of its work. These committees shall have no independent executive power. Their function shall be to advise the Council on the subjects with which they deal. Any Member or Associate of the Faculty may be appointed to serve on them, but the chairman of every standing

committee shall be a member of the Council. Persons not Members or Associates may be co-opted for temporary service on standing committees when required.

The same rules shall apply with regard to period of service on a standing committee as in the case of the Council.

Special Committees. The Council shall have power to appoint special committees to deal with special subjects and report thereon to the Council. Persons who are not Members or Associates of the Faculty may be invited to serve on special committees, and these committees may be given power to co-opt such persons.

Subscriptions

Members of the Faculty shall pay an initial subscription of three guineas and Associates one of one guinea. The subsequent subscription shall be determined by the Council.

It is anticipated that the new Faculty will work in co-operation with the Universities, Royal Colleges and Corporations of Great Britain and Northern Ireland, and maintain a close liaison with the Ophthalmic Group Committee of the British Medical Association.

The Council of British Ophthalmologists has appointed a special committee to organise the Faculty, to enrol Members and Associates, and to make the necessary arrangements as soon as possible for the election of the Council. When the new Council has been established it will assume all the functions of the present Council of British Ophthalmologists, which will hand over all its records and any other property in its possession.

Forms of application for enrolment as Members or Associates may be obtained from the Hon. Secretary of the organising committee:—

MR. FRANK W. LAW,
45, Lincoln's Inn Fields,
London, W.C.2

ABSTRACTS

MISCELLANEOUS

(1) **Glover, L. P. and Brewer, W. R. (Altoona, Pennsylvania).—An ophthalmologic review of more than twenty thousand men at the Altoona Induction Centre.** *Amer. Jl. Ophthal.,* Vol. XXVII, p. 346, 1944.

(1) **Glover** and **Brewer** give a statistical table of the incidence of refractive errors, congenital defects, injuries and ocular diseases

found in 21,446 men. They found that 21·36 per cent. had eye defects which reduced visual acuity to 20/40 or less.

H. B. STALLARD.

(2) **Reese, A. B. (New York).—Pigment freckles of the iris (benign melanomas): Their significance in relation to malignant melanoma of the uvea.** *Amer. Jl. Ophthal.*, Vol. XXVII, p. 217, 1944.

(2) **Reese** found iris freckles (multiple benign melanomas) in 48 per cent. of 300 adult patients. In 31 per cent. these were present in both irides. The author noted the more frequent occurrence of benign melanomas of the iris in the microscopic sections of eyes harbouring malignant melanomas of the uveal tract.

H. B. STALLARD.

(3) **Berens, C. (New York) and McAlpine, P. T. (Summit, New Jersey).—Solar kerato-conjunctivitis associated with amblyopia.** *Amer. Jl. Ophthal.*, Vol. XXVII, p. 227, 1944.

(3) **Berens** and **McAlpine** report the effects of an open-arc lamp on the eyes of two brothers, who had three 15 minute exposures within 48 hours. After this, vision was reduced to hand movements and the visual fields to a temporal cresent in each eye. There was gradual recovery of the visual acuity and visual fields in the course of 11 days. It is probable that the temporary amblyopia in these patients was caused by the thermal effects of the carbon arc lamp on the retina.

H. B. STALLARD.

(4) **Gibson, G. G. (Philadelphia). — Trans-scleral lacrimal-canaliculus transplants.** *Amer. Jl. Ophthal.*, Vol. XXVII, p. 258, 1944.

(4) **Gibson** describes his technical trials in attempting to create an epithelial-lined channel between the anterior chamber and the subconjunctival tissues by implanting a piece of lacrimal canaliculus in a scleral incision. He tried to maintain the lumen by leaving in it strands of catgut knotted at each end. In experimental dogs a number of mishaps occurred. In some the canaliculus implant was permeable for a time. The operation was tried on a patient with advanced glaucoma. Intra-ocular infection occurred at the site of the catgut knot projecting from the end of the canaliculus in the anterior chamber. This subsided after treatment with sulphathiazole and intravenous typhoid vaccine but the canaliculus became occluded later. It is evident that this operation in its present form is unlikely to be successful.

H. B. STALLARD.

BOOK NOTICE

A Pathology of the Eye. By EUGENE WOLFF, M.B., B.S.(Lond.), F.R.C.S.(Eng.). Second edition, with illustrations. London: H. K. Lewis & Co. 1944. Price, £2 2s.

The post of pathologist to an ophthalmic hospital has in the past afforded a well-worn stepping stone to those who would cross the stream separating them from its honorary staff. Once the objective has been reached, however, the stone is left in mid-stream, to be occupied by the next aspirant, with the result that ophthalmic pathology has been largely in the hands of those who have had relatively little experience in this highly specialised subject. Such is not the case with regard to the author of this book, who has been Pathologist to the Royal Westminster Ophthalmic Hospital for some fourteen years, and gives in his writing the results of his long experience. The first edition of "A Pathology of the Eye" contained a fair proportion of clinical material, inserted to leaven what might be regarded as the heavy pabulum of pure pathology. With further experience, however, the author has found that this is not necessary, and the clinical material has been largely omitted, more space being devoted to morbid histology. This has meant re-writing a great deal of the text so that the volume under review is almost a new book. It deals in systematic manner with diseases of the various structures of the eye and has special chapters on glaucoma, injuries, congenital anomalies, new growths, errors of refraction, diabetes and general pathology. It ends with a full bibliography. The writing of the book is simple and clear and very little has been left out. The 212 illustrations are admirable, and call for a special word of praise for the meticulous care with which they have been drawn to illustrate the various points they have to show.

"A Pathology of the Eye" will be invaluable to candidates for one of the diplomas of Ophthalmology, and also to those who sit for the higher degrees. Established ophthalmologists will, however, find much to interest them—the chapter on the vitreous, for example, the differences between the histology of the retina in Tay-Sachs' disease and in cerebro-macular degeneration, and between the optic nerve changes in disseminated sclerosis and neuro-myelitis optica.

Although the fly-leaf has on it a notice reading "Book production, war economy standard," it would be hard for the reader to detect any difference between the format of this volume and those which were produced before the War. Possibly the word "economy" is used in its wider sense, and war economy has been seen to include a high standard in the production of medical text books. Whatever the explanation, the publishers are to be congratulated on the excellence of their paper, printing and binding. Restriction in

number of pages may, however, have brought about a notable omission in this volume, since there is no chapter on practical methods—embedding, staining, etc. This is certainly called for, because many of the procedures used are special to ophthalmic pathology, and descriptions of those which have proved of service to the author would have great value to his co-workers in other hospitals.

We cannot conclude without congratulating Dr. Wolff upon a notable addition to British Ophthalmic literature.

CORRESPONDENCE

PENICILLIN

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—I have read with great interest the article on penicillin by T. Crawford and E. F. King.

Their experience is almost identical with my own, with the exception that I use a stronger solution, 500 units, in 1 c.c., and I dealt simply with conjunctivitis and not ulcers. The results are varied. Most of them have been favourable, some almost dramatic. One child who had taken one month to get rid of ophthalmia, had a recurrence which was cured in two days by penicillin. But the remarkable feature is the difficulty I have had in getting any organisms from the eye. I note in case 25 they have the same experience. In one severe case I had, we removed a piece of the conjunctiva and failed to show any organism. There is, however, another fact that cannot be overlooked. With all new drugs there are unexplained conditions and evidences of human fallibility.

Long ago I took up the history in detail of eserine and homatropine, and went through the literature from beginning to end. The striking feature was at the outset they cured all sorts of diseases, and as year by year passed, the claims diminished until they reached all uses of which they are now put.

Penicillin has been a great development, but I now cannot tell why the majority of cases in ophthalmia do well, and some fail. We shall learn as time goes on. The only ill effects I have seen are swelling under the lower lid apart from the eye. It was not serious, and soon passed away.

I am, etc.,

JAMES W. BARRETT.

MELBOURNE,
October 19, 1944.

NOTES

Death

As we go to press we learn with deep regret of the death of Sir Thomas Barlow in his one hundredth year. Sir Thomas was one of the small committee appointed in 1880 to arrange for the foundation of the Ophthalmological Society of the United Kingdom. He was an original member of the Society and on retirement, about 12 years ago, was elected an honorary member. His name is a household word in medicine. He will be greatly missed, particularly in connexion with the working of the Royal Medical Benovelent Fund, in which he had always taken great interest, and the fund owes a lasting debt of gratitude to him. His death leaves Sir Lindo Ferguson the sole surviving original member of the Ophthalmological Society.

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Honours

IT is announced that Miss Ida Mann has been elected Professor of Ophthalmology at the University of Oxford. She is the first lady to be elected to professorial rank at the University, and she will hold office so long as she retains the Margaret Ogilvie Readership in Ophthalmology. Just as a lady can take the chair at a meeting and be addressed as Mr. Chairman without any impropriety, or anything derogatory to what Mr. Wackford Squeers would have called her gender, so a lady can be a professor, and we need not think of her as a professoress. British ophthalmology will wish to congratulate Miss Mann on this well deserved honour; and the editorial department of the journal hopes that she may long continue to occupy the new chair; and, to borrow from one of Thackeray's "Roundabout Papers," that she may never find a thorn in the cushion. These are the peculiar perquisites of editors.

SIR HERBERT L. EASON has been re-elected President of the General Medical Council; and Mr. Bishop Harman, a Vice-President of the British Medical Association.

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Special Notice

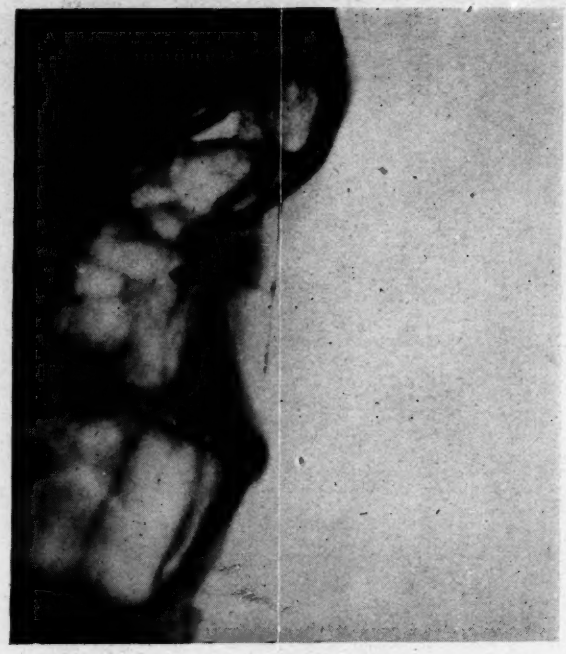
WE are asked by the Ministry of Information to state that the fact that goods made of raw materials in short supply owing to war conditions are advertised in this journal should not be taken as an indication that they are necessarily available for export.

A. *Direct lateral view.*—X-rays not truly lateral, thus nasal edge of ring shows in front : f.b. correctly placed *re* temporal edge of ring.

B. Direct lateral view.

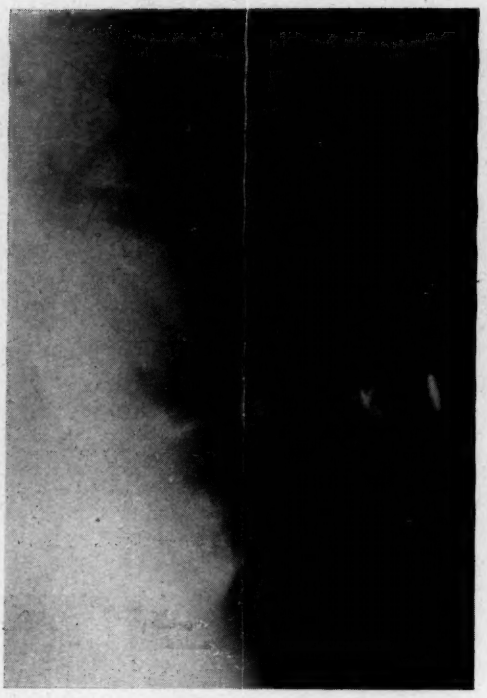
C. Direct lateral of orbit. N.B.—Both the larger and the tiny f.bs. were identified and removed at operation. Paresis of the internal rectus muscle with diplopia remains.

C. Oblique lateral.

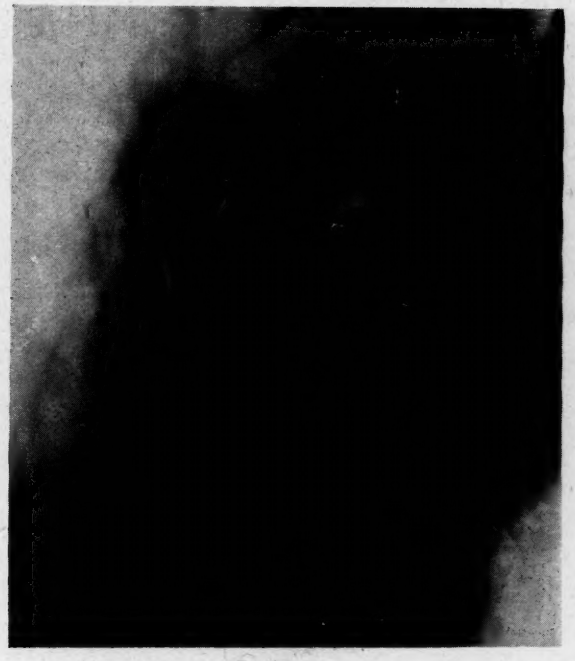


A. Oblique lateral view.—Eye turned laterally to left, showing f.b. more posterior to temporal edge of ring-eye has turned while ring has only tilted to the left.

B. Oblique lateral view.—Lead bead denoting nasal edge of ring appears in front, *i.e.*, ring tilted laterally as eye is turned laterally.



C. Wounded July, 1944, while in a tank blown up by a mine. At operation July 29, 1944, a piece of thin sheet metal was removed from the internal rectus muscle near its origin.



A. Left eye.—Shell wound February, 1944, entrance wound 1 oclock with localised lens opacity, and peripheral iridectomy. Iron fragment removed at operation July 31, 1944, embedded in sclera, projecting inside globe and outside, which was covered by adherent external rectus muscle posterior to equator. Much vitreous opacity and old vitreous haemorrhage. V. 6/60.

B. Right eye.—Shell wound, January, 1944, entrance wound through sclera and lateral rectus tendon. Giant magnet negative at numerous trials. Much vitreous haemorrhage—nil seen inside eye, which slowly depreciated, becoming soft with fine keratitis punctata.
Enucleated August 8, 1944. ? Iron (very weakly magnetic) f.b. found encapsulated in organised tissue firmly adherent to sclera and ciliary body on nasal side—a firm organised band crossed the vitreous to the scleral site of entry wound. N.B.—Is not magnetic like ordinary steel.